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ABSTRACT

Over 60 energy education activities related to mathematics, science, social studies, and English comprise this manual for middle school teachers. Included are issues for discussion, puzzles, science investigations, story writing exercises, and energy cost calculation problems. Among the topics covered in these lessons are energy consumption trends, pollution problems, energy resources, conservation strategies, and historical perspectives on energy use. (WB)

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OKEECHOBEE COUNTY
ENERGY EDUCATION ACTIVITIES

-MIDDLE SCHOOL LEVEL-

U.S. DEPARTMENT OF HEALTH
EDUCATION & WELFARE
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DIMENSIONS OF THE ENERGY PROBLEM

A. Short Range Dimensions - to 2000 A.D.

1. Scarcity of petroleum and natural gas
2. Increasing cost of usable energy
3. Energy-related environmental problems
4. Energy-related social-economic problems
5. The nuclear controversy
6. A shortage of capital for development
7. Cultural and lifestyle adjustments
8. Increasing centralization of energy and economic power

B. Long Range Dimensions - Beyond 2000 A.D.

1. Substitute(s) for high-quality fossil fuels
2. National and world-wide energy inequities
3. Increasing centralization of energy and capital
4. Long range environmental effects

- From John M. Fowler
National Science Teachers Association

THREE LEVELS OF KNOWLEDGE IN ENERGY EDUCATION

1. Practical "Know-How" for Energy Conservation

Example: Replacing a hot water faucet washer
Insulating water heaters and pipes
Defrosting your refrigerator

2. Specific Knowledge of American and World Energy Realities: Historical, Contemporary, and Future

Example: Growth in coal consumption and consequences
Fusion research in the U.S.A.
Potential for low-head hydro-electric

3. Powerful Explanatory Principles from Science

Example: Energy conversion loss
Net energy
Hubbard Curves
Exponential growth

Practical "Know-How" for Energy Conservation: What are the Basic Competencies for Energy Efficient Adults?

1. Know-How to reduce heating and air conditioning losses in a home and work place (i.e., caulking, window repair, weather-stripping, insulation and

R-values, moisture barriers, etc.) to increase efficiency.

2. Know-How to manage home electric, oil, and gas consumption (i.e., read meters and measure consumption, interpret utility bill, recordkeeping, perceive relationships between energy use, energy meters, energy costs, household behavior, and Florida's climate).

3. Know-How to manage hot water in the home and work place (i.e., insulated water heater and hot water pipes, setting water heater thermostate, install and use electric water heater timers, install faucet washers, seats, and water flow restrictions, etc.).

4. Know-How to purchase and use efficently household and work place appliances (i.e., use EER labels, think in terms of life-cycle costs, appropriate technology, and shared-use with neighbors and family, consolidate cooking, washing, and other appliance use, etc.).

5. Know-How to use passive solar techniques in energy management at home and in the work place (i.e., roof overhangs, screening, and landscaping, window and other ventilating opportunities in the attic and living space, dress appropriately, drapes and window/door treatment, interior and exterior color treatment, etc.).

6. Know-How to manage energy consumption in personal vehicles and work vehicles (i.e., fill gasoline tank, change air, fuel, oil and other filters, change anti-freeze and oil, drive defensively and energy efficiently, lubricate vehicles, and care for parts to maximumize life-time expectancy, inflate and rotate tires, compute miles per gallon, tune-up, cleaning and changing plugs, consolidation of trips in vehicles, etc.).

7. Know-How to grow, harvest, preserve, and prepare food in energy efficient ways (i.e., organic gardening; mulch and composting, cold frames; refrigerator setting, operation, and defrosting; freezer full when operating; oven and microwave cooking; etc.).

8. Know-How to do a simple home and work place audit, using the handbook from the Governor's Energy Office, 301 Bryant Building, Tallahassee, FL 32301, Attention: Ann Stanton.

9. Know-How to recycle what is possible from the household and work place (i.e., compost kitchen scraps and paper; recycle aluminum cans and newspapers; compost lawn trimmings and leaves; turn egg cartons into plant starters; recycle nails, screws, and bolts; etc.).

THIRTEEN POWERFUL EXPLANATORY PRINCIPLES:

What are the few, powerful principles for thinking about energy issues?

1. The material earth system is finite--there are limits to what we as humans have to work with.

2. Our world system is essentially closed in a material sense. What we have to work with is already here.

3. The earth is open to energy from the sun--and over the long run is in a steady state condition (equilibrium).

4. The earth is an interlinked system such that actions on one part may affect other parts. Some portions of the earth are natural systems, with natural flows of energy and material through interrelated parts of those eco-systems. Human systems (i.e., economics, societies, cities) are interdependent--and bound over for their efficient operation, and given survival, on natural systems.

5. Human beings can apply additional energy to natural systems and make them more efficient (productive), but there is an optimum application of energy to natural and human systems--beyond that, the application of energy is affected by diminishing returns per unit of energy invested, and destructive (imbalancing) forces set in.

6. In human and natural systems, there is no free lunch--no free good thing. All good things must be paid for now or later in some way.

7. While energy cannot be created or destroyed in theory, in practice, energy conversions in natural or human systems are inefficient and involve energy loss--as heat into the environment.

8. In human systems, energy sources with a high positive net energy return tend to be consumed first. Net Energy is the amount of energy available to do work after subtracting the energy required to obtain that energy supply.

9. Organized, high quality natural resources (matter and energy) are continually dispersed by industrialized societies. High quality energy is dispersed as low-grade heat into eco-systems.

10. Destructive forces in natural and human systems may be very rapid; constructive forces tend to be slow. Destructive processes are almost more rapid than the corresponding constructive ones.

11. Natural homeostatic systems have finite limits--and delicate balances of energy flows.

12. For all that our physical world system is finite, there seems to be no limit to the creative potential of human beings to live well, within the optimum levels for natural and human systems.

13. Human survival with reasonable quality of life is one suitable criterion for judging behavior and public policies--all of which impact human and natural systems. Quality of life is a broader concept than immediate self-interest and material standard of living.

*After Harold G. Cassidy, "Boundary Conditions in Energy and Ecology," Bulletin of the Atomic Scientists, Volume 33, No. 3 (March, 1977), 31-33.

DISCUSSING ENERGY VALUE ISSUES

A. Indicate where you stand on a particular issue by marking your position on the line extending from one extreme to the other...

1. How important is conservation to you?

: : : : : :

Not very, technology makes its doom inevitable...	Somewhat, but realistic about its place in modern world...	Very, life itself is dependent upon its maintenance...

2. How important is energy independence to you?

: : : : : :

Not very, world must learn to share resources if we are to survive...	Somewhat, but must balance what we have and what is purchased...	Essential, we can't depend on anyone but ourselves...

3. How important is maintaining your present lifestyle to you?

: : : : : :

Very, content, and do not wish to change...	Somewhat, basically sound but some changes needed...	Not at all, lifestyles must change to adapt to changing world...

4. How important are sacrifice and/or hard work in achieving a long-range goal to you?

: : : : : :

Not very, long-range goals often change or are obsolete by time you reach them...	Somewhat, hard work and sacrifice are good for people even if goals aren't achieved...	Very much so, hard work and sacrifice are always best way of assuring success...

- M. S. Torres

B. From the pulpit last Sunday, the Rev. George Hall addressed the problem of the growing population and the earth's limited resources. The title of his sermon said it all: "There's room enough in the world for everybody except the greedy."

From: Better Homes and Gardens
April, 1980
Page 194

DISCUSSION QUESTIONS:

1. What do you think Rev. Hall meant by his use of the term "the greedy"?

2. In terms of energy, are there people who could be considered "greedy"? If so, who are they?

3. Are there ways in which your own use of energy could be considered "greedy"?

4. Are there things that our government should do to control production and use of energy resources?

- Chris Burton

C. Mary was from a rural area, accustomed to getting into the car whenever she needed something and going to several stores to find it if necessary. Now she is a career woman in the city, but still has this habit. She has noticed, however, that it takes her too much time to do this in the city, besides she sees that she is using too much gasoline. She is trying to remember to use the telephone first, but old habits are hard to break.

DISCUSSION QUESTIONS:

1. How does telephoning ahead save energy?

2. How has Mary's value for the amount of money spent for gasoline changed?

3. What can Mary do to remind herself of the importance to call a store first to see if they have the item she wants?

4. Even if Mary could well afford the gasoline, shouldn't she still consider the energy crisis?

- Sandra L. Rice

D. A teacher in an elementary school in a problem area of town experiences a great deal of stress in her job. To release tension she likes to go flying on weekends, as this really helps her relax. She has just learned that her state representative is sponsoring a bill to add 50¢ tax per gallon on fuel used for recreational purposes. If this happens, it will be difficult for her to continue her hobby, as her teaching salary is too low and she is on a tight budget.

DISCUSSION QUESTIONS:

1. Would elimination of the use of energy for recreational purposes be enough to help solve the energy crisis?

2. Would a person's well-being be important enough to offset the cost of this fuel?

3. Should she organize other pilots to lobby aginst this bill, pointing out their right to recreation?

4. Should she consider another hobby, although this is something she has wanted to do since she was a little girl?

- Sandra L. Rice

E. Ned lives in a part of town that has a church of his denomination near him, but the congregation members are mostly older and the church has no youth program. The church that he and his family have been attending is 15 miles away, but the activities for youth have been spiritually uplifting. In order for Ned to attend, his folks have to take him and return for him, as he does not yet drive. The family is concerned about using so much gasoline.

DISCUSSION QUESTIONS:

1. How important is fellowship and spiritual development to Ned?

2. Should Ned try to find other youngsters in his neighborhood to go with him and share rides with them?

3. Could Ned's parents become youth leaders, thus avoiding one of the trips?

4. Should Ned decide that his spiritual development is important and resolve to save gasoline in other ways?

- Sandra L. Rice

F. The school board has re-routed buses so that children will be picked up more efficiently, thus saving gasoline. In order to accomplish this, it was ruled that no child who lived two miles or less from school could ride the school bus. This would make it possible to consolidate several routes. However, a group of children who live 1.8 miles from school have to cross a busy highway on their way to the school to which they have been assigned.

DISCUSSION QUESTIONS:

1. How important is saving gasoline in comparison to the risk these children take in crossing the busy highway?

2. Should parents be allowed to send their children to another school 2.3 miles away? This way they could ride the bus and there would be no busy highway to cross.

3. Should a crossing guard be hired to help the children cross the busy highway?

4. Should you as a parent decide to drive your child to school because of the risk involved in crossing the busy highway?

5. What are some other alternatives?

- Sandra L. Rice

How do you know when you are really saving energy and when you are using too much?

No "expert" can tell you exactly how much energy you can or should use, but you might be able to tell yourself if you try to put yourself on an energy budget.

There are three guidelines to help.

1. Stay as close to the source of things as possible.
If you use things as close to the way nature makes or uses them, you are probably saving energy.

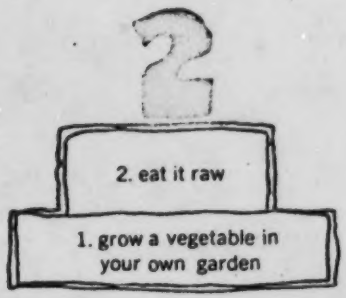
2. Buy and use products which are long-lasting and efficient.
When buying objects look for simply constructed, solidly built items that will last a long time. Avoid fancy extras and fad items. Invest in items which will save energy rather than in items which use more energy. It's wiser to pay more for something now, than to have to pay for more expensive fuels in the future.

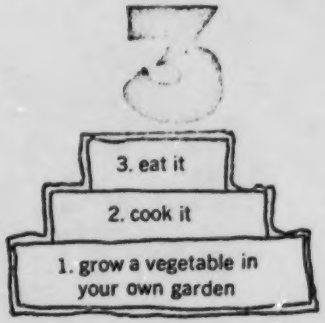
3. Look at the whole energy picture of the things you use.
Take a hard look at what you are in terms of energy use.
What forms of energy do you use directly?
What forms of energy do you need to live a healthy life?
What forms of indirect energy are in the things you use everyday?
—Of all of these things, which are absolutely essential?
—Which things are not absolutely necessary, but help give your life a quality you think is important?
—Which things are really unnecessary?

After you have made these assessments, decide on a few ways you can begin using less energy today—not tomorrow.

Stepping Off Energy

We can compare the different ways people use energy. Pyramids can be drawn to illustrate how we use energy in our everyday life. Try this activity to help you see the whole energy picture of some of the things you use. We've used food as an example.





6
6. eat it
5. take it home and cook it
4. you drive to market and buy it
3. refrigerates it at the market
2. transports it to market
1. someone else grows a vegetable

12
12. eat it
11. throw away package
10. thaw it & cook it
9. take home & put in freezer
8. you drive to market to buy it
7. market keeps it frozen
6. refrigerated truck takes it to market
5. it is frozen
4. it is packaged
3. it is sliced by machine
2. transports it to a processing plant
1. someone else grows a vegetable

TEST YOURSELF . . . YOUR ENERGY CHECKLIST

No doubt you are now trying to conserve energy. This checklist will help you recognize the energy conservation practices you now use, and identify ways you can become an even better energy manager.

Have Done	Will Do	
		Insulation Reduces Heat Loss or Heat Gain, Improves Comfort, and Reduces Energy Required for Heating and Cooling.
☐	☐	Ceiling—minimum 6-inch mineral wool equivalent.
☐	☐	Walls—minimum 4-inch mineral wool equivalent.
☐	☐	Crawl space or unheated basement—minimum 2-inch mineral wool equivalent.
		Window Protection for Winter
☐	☐	Install storm windows, or
☐	☐	Double or triple glazing, or
☐	☐	Cover windows with plastic.
		Utilize Winter Sun
☐	☐	South and west window exposures are best for living areas.
		Protect House from Cold Winter Wind
☐	☐	Plant, or build a windbreak landscape treatment.
☐	☐	Design house for maximum protection.
☐	☐	Protect entrances.

Have Done	Will Do	
		Seal Air Leaks
☐	☐	Weatherstrip doors and windows.
☐	☐	Caulk cracks.
☐	☐	Seal unused doors.
		Protect House from Summer Sun
☐	☐	Plant trees.
☐	☐	Install a roof overhang to protect windows.
☐	☐	Use awnings or other treatment.
		Utilize Breezes for Cooling During Warm Season
☐	☐	Open windows in evening.
☐	☐	Close during mid-day.
		Temperature Control
☐	☐	Reduce daytime home heating in winter, maintaining 68° F. or lower temperature.
☐	☐	Set air-conditioning unit to recirculate cool air instead of pulling in warmer outside air.
☐	☐	Increase temperature setting for summer air-conditioning, 78° F. or higher.
☐	☐	Reduce nighttime winter temperature 5°-8° or more.

Have Done	Will Do	
☐	☐	Use window and attic fans for cooling during summer when outside temperature is below house temperature.
☐	☐	Maintain heating and cooling equipment in good operating condition.
☐	☐	Keep air filters clean to make it easier for heating and cooling system to do its job.
☐	☐	Close off unused rooms and closets.
☐	☐	Use kitchen and bathroom exhaust fans only when necessary.
☐	☐	Install an exhaust fan in the attic to remove hot air in the summer.
☐	☐	Shade windows from direct sun in summer with draperies and roll-up shades.
☐	☐	Open draperies and roll up shades to receive sun's heat in winter.
☐	☐	Close door of attached garage in winter.
☐	☐	Close off flue when fireplace is not in use.
☐	☐	Select an energy efficient air-conditioning unit the proper size for space to be cooled. It is better to buy a slightly undersized unit, rather than an oversized one.
☐	☐	Repair leaks and insulate heating and cooling ducts in spaces not heated or cooled.

Have Done	Will Do	
☐	☐	Reduce heating and cooling temperatures when away from home for long periods of time.

Lighting

☐	☐	Turn off unnecessary lights, indoors and out.
☐	☐	Reduce lighting levels to minimum for task to be performed.
☐	☐	Use bulbs with lower wattage in halls, stairways, and other areas of general illumination.
☐	☐	Use light colors in decorating to improve lighting efficiency.
☐	☐	Do tasks which require a high light level during the daylight hours when possible.
☐	☐	Keep lighting fixtures clean.
☐	☐	Use fluorescent lighting for maximum light from electrical energy used.
☐	☐	Use timers to turn lights on in the evening rather than leaving lights on all day when no one is home.

Heating Water

☐	☐	Reduce the amount of hot water used.
☐	☐	Insulate long hot water pipes, especially those under the house or those that go through unheated basements.

Have Done	Will Do	
☐	☐	Repair leaky faucets.
☐	☐	Maintain regular temperature setting of 140° F. on water heater when hot water is needed.

Laundry

☐	☐	Wash only full loads of laundry.
☐	☐	Use heated water in only the washing cycle.
☐	☐	Use water no hotter than necessary for adequate soil removal and sanitation.
☐	☐	Use good laundry techniques to obtain satisfactory results in one washing process.
☐	☐	Avoid over drying in the dryer.
☐	☐	Line dry garments and household items when practical.
☐	☐	Use the dryer efficiently. Avoid drying one or two items at one time.
☐	☐	Remove items when dryer stops to avoid unnecessary wrinkling, which will require pressing to remove.
☐	☐	Reduce ironing to a minimum by careful selection of garments and household linens.

Cleaning and Maintenance

☐	☐	Empty or replace vacuum cleaner bag frequently to keep it functioning efficiently.
☐	☐	Eliminate unnecessary vacuuming and floor polishing.
☐	☐	Use hand equipment rather than power equipment when practical.
☐	☐	Develop preventative maintenance practices. Routine checkup and servicing will prevent greater problems later.

Cooking and Baking

☐	☐	Use oven to capacity.
☐	☐	Use cooking utensils which fit the electric unit or gas burner.
☐	☐	Use tight-fitting lids on cooking utensils, when appropriate.
☐	☐	Reduce heat to maintain necessary cooking temperature when using surface units or burners.
☐	☐	Use small appliances for cooking, baking, and toasting if they are more efficient than the range.
☐	☐	Preheat oven only when necessary. Do not preheat longer than needed to attain required temperature.
☐	☐	Turn off oven, surface units, or burners promptly when food is cooked.

Refrigeration—Refrigerator and Freezer

☐	☐	Avoid opening door or holding it open unnecessarily.
☐	☐	Keep grills and evaporator coils clean.

Have Done	Will Do	
☐	☐	Locate cooling appliances away from a heat source such as the range, hot air register, or direct sun.
☐	☐	Defrost as needed.
☐	☐	If cold air is leaking around door, have door adjusted or gasket replaced.
☐	☐	Turn off, empty, clean and leave refrigerator door open when taking an extended vacation.
☐	☐	Locate the refrigerator and freezer away from heat sources.

Dishwashing

☐	☐	Accumulate dishes; hold until the dishwasher is filled. If dishes are hand washed, rinse and hold breakfast dishes until noon or evening.
☐	☐	Avoid wasting hot water by leaving it run continuously while washing or rinsing dishes.

Personal Care

☐	☐	Minimize hot water used in bathing. Check to see if less water is used in showering than in tub bathing.
☐	☐	Do not leave water running while shaving, brushing teeth, etc.
☐	☐	Turn off faucets promptly after use.

Recreation and Entertainment

☐	☐	Turn off TV, radio, or stereo when no one is really watching or listening.

Have Done	Will Do	
☐	☐	Disconnect or use vacation setting on an instant-on TV when you are not going to be using it regularly.
☐	☐	Use shop or hobby equipment efficiently.
☐	☐	Maintain tools in good operating condition.
☐	☐	Encourage family members to develop leisure activities such as bicycling, hiking, reading, swimming, etc., that have low energy costs.
☐	☐	Spend vacations closer to home.
☐	☐	Encourage home and neighborhood activities.

The Family Automobile

		Drive at a moderate speed.
☐	☐	Drive smoothly with gradual starts and stops.
☐	☐	Don't warm up the car for more than a minute or two before driving.
☐	☐	Provide proper maintenance; make sure you have well-tuned engines and properly inflated tires.
☐	☐	Combine errands by careful planning.
☐	☐	Carpool whenever possible.

Other Transportation

☐	☐	Walk, ride a bicycle, or use public transportation whenever possible.
☐	☐	Travel only when necessary.

W O I N T E C E R T Z I P H E A T E R S A V E I Q P A N
S A N I P A O N M O R F R E E Z E R C O U S E R V E E O
N L S U X T N O M I L K S A V E U S O W I M E L Y V E I
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E O N T O U R S A T E O R U C O N S E R V E U C E N T S
D O O R S D H I V E L E C T R I C I T Y U W I N D O W S

Here are ways you can help . . . SAVE AMERICA'S ENERGY.
Check the capitalized words in the "wise ways to save electricity" messages below and find them in the letters above, as per example. The words sometimes read forward, at other times backwards, up, down; or even diagonally. You get 5 points for each word located. A perfect score is 100, but also find the words ENERGY OWL and You're "No. 1."

To CONSERVE ENERGY and SAVE DOLLARS, help your parents follows these rules in your home and become . . . a "No. 1 Energy Owl."

WISE WAYS TO SAVE ELECTRICITY

The HEAT PUMP is most economical for heating and cooling.

Install storm WINDOWS and doors.

Flip off LIGHTS when not in use.

Keep WATER heater set at 150°.

Repair leaky FAUCETS.

Wash only full loads in clothes WASHER.

Use WARM water for washing.

Use FLUORESCENT lamps where possible.

INSULATION: 6 inches in ceiling; 3-1/2 inches in walls; 2 inches in floors.

Set THERMOSTAT at 68° in winter.

Use small APPLIANCES instead of range.

Close door of REFRIGERATOR quickly.

Use correct size LAMPS in fixtures.

Turn off TELEVISION when not in use.

Locate water HEATER near point of greatest use.

Run full loads in DISHWASHER.

Keep thermostat at 78° in SUMMER.

Insulate hot water PIPES.

COOK complete meals in oven.

Keep FREEZER full.

ENERGY OWL Teacher's Answer Sheet

W	O	I	N	T	E	C	E	R	T	Z	I	P	H	E	A	T	E	R	S
S	A	N	I	P	A	O	N	M	O	R	F	R	E	E	Z	E	R	C	O
N	L	S	U	X	T	N	O	M	I	L	K	S	A	V	E	U	S	O	W
F	O	U	H	L	O	S	B	E	T	T	E	R	T	O	L	I	A	N	M
O	F	L	U	E	I	E	W	E	N	T	L	O	P	I	E	N	V	T	E
L	L	A	U	A	R	R	O	A	L	V	T	A	U	N	C	Q	E	U	N
D	U	T	A	K	E	V	R	E	R	O	I	D	M	T	T	U	C	R	E
F	N	I	P	E	N	E	R	G	Y	M	V	A	P	O	F	L	U	O	R
A	O	O	D	S	N	O	W	A	V	E	B	O	A	R	I	E	A	V	R
U	R	N	A	P	P	L	I	A	N	C	E	S	U	N	C	T	L	E	E
C	D	U	L	L	O	D	E	Z	I	G	E	R	A	L	A	T	O	N	F
E	R	D	U	A	W	I	V	I	F	A	U	C	E	T	S	O	Z	A	R
T	Y	F	O	M	E	S	H	A	V	E	O	V	S	S	E	C	N	V	I
S	E	P	I	P	R	H	E	T	E	S	H	O	W	E	R	S	T	O	G
I	R	E	Z	S	A	W	R	D	S	U	M	O	R	E	G	R	E	N	E
N	M	O	U	Q	S	A	H	N	T	S	O	S	T	N	E	C	S	E	R
K	I	P	C	H	E	S	A	T	E	Z	S	A	V	E	F	U	E	L	A
I	T	L	O	T	W	H	E	O	S	A	W	V	N	M	O	N	E	Y	T
T	G	E	A	U	C	E	T	H	E	R	M	O	S	T	A	T	O	U	O
E	O	N	T	O	U	R	S	A	T	E	O	R	U	C	O	N	S	E	R
D	O	O	R	S	D	H	I	V	E	L	E	C	T	R	I	C	I	T	Y

S	A	V	E	I	Q	P	A	N											
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V	E	U	S	O	W	I	M	E	L	Y	V	E	I						
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P	I	E	N	V	T	E	M	A	L	E	O	V	N	I					
U	N	C	Q	E	U	N	O	V	T	U	R	E	I	V					
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W	I	N	D	O	W	S													

FOURTEEN GREAT IDEAS FOR EXPRESSING THOUGHTS ABOUT ENERGY CONSERVATION

1. Conduct an "Energy Awareness Week" for your school. Show movies and slides; sponsor a contest for the best "energy crisis" poster; set up energy displays in the school. (Many of the projects below could also be part of this week.)

2. Determine the many ways energy is used in a specific area (for example, within 3 blocks of your school). What are the types of energy used? How is energy wasted?

3. Have your school principal turn off the electricity and/or air conditioner for one hour or for a day. Have your class interview teachers, school workers, and students for their feelings and reactions to this. Discuss the results of the survey. Do people have a different attitude about these amenities after such an experience? Do we take them too much for granted? How do we balance out the "good" of energy with the "bad" of pollution and other side-effects?

4. List five ways that electricity has improved your standard of living.

5. Write a paragraph on what changes would take place in your home if the electrical energy supply was reduced in half.

6. Explore and report on probable consequences of long-term fuel shortages on: food, clothing and textiles, cosmetics, plastics, household supplies, travel, transportation, retailing, fast food operations, autos.

7. How would you view the fuel shortage if you were: owner of a large car, a coal miner, a lumberjack cutting timber in Oregon, a person specializing in installing insulation, a truck driver (long-distance), an automobile manufacturer, a "rough neck" working in an Oklahoma oil field, a meter reader for a public utility firm, retired person living on a fixed income (social security), a service station manager, an electric appliance manufacturer, manager of a suburban shopping center store, owner of a block of downtown stores? What steps would you take to improve your position in each of these situations?

8. Make a mural which describes the uses of fuel from wood to nuclear fuel as man's technology advanced. Include wood, peat, lignite, coal, oil, natural gas, nuclear fission, and nuclear fusion. (This project could involve several students, with some conducting research and others doing the artwork.)

9. Create bulletin board displays of pictures, articles and clippings from current magazines and newspapers which depict the energy situation. Arrange to show these in school and, if possible, in public buildings and retail stores in the community.

10. Draw a cartoon on the energy shortage for publication in the school or local newspaper. Cartoons could show humorous aspects of conserving energy.

11. Have each student bring in five unique pictures showing energy misuse. Teams of five students then could make a collage using all the pictures. Further, they could write a poem about the collage.

12. Write a play on "U.S. Energy." For example, the play might be titled "How Did We Get to Where We Are Now", and might include as characters: "Crude" Oil, "Nat" U. Gas, Harry Hydro, "Nuke" Power, Clarence Coal, Sally Colar, G. O. Thermal, Wendy Mills, and Oily Shales. Consider taking the play around to other schools in the district.

13. Prepare and publish a booklet on "Ways Kids Can Help to Save Energy" - in the home, in the school, in the car, in stores, and in the community.

14. Topics for Energy Thought Papers:

    a) Write or tape an imaginary interview with a figure from history about energy uses in his time and compare them with energy uses today.
    b) Do you believe the the energy shortage has any influence upon or is in any way connected to the concerns about the environment?
    c) Who or what do you think is responsible for the energy crisis? How long ago should we have recognized the looming problem? Why didn't we respond earlier?
    d) What can be done by commercial establishments to conserve energy? How would these measures affect employees, customers and management? Have you personally noticed any changes?
    e) In what ways might a fuel shortage affect your family life? Think in terms of benefits, hardships and end results.

MEANINGS

Give students one (or more) of the following quotations, and ask them to explain the meaning in their own words.

1. "We are in the autumn of the petroleum age."

- Reubin Askew
Governor of Florida, 1978

2. "Energy waste is treason, it aids America's enemies!"

- Richard Adams
March, 1981

3. "Energy companies are using more energy to get energy today."

- Reubin Askew
Governor of Florida, 1978

4. "Don't be fuelish."

- U. S. Department of Energy, 1979

5. "The seeds of our destruction are to be found at our local gas stations."

- Wayne H. Duncan
March, 1981

6. "On energy matters, we are our worst enemy."

- Diana Adams
Okeechobee, 1981

7. "As we buy oil abroad in vast quantities, we trade our heritage off."

- Nella Yendor
Tallahassee, 1981

8. "Save it, Florida!"

- Rosalyn Tillis
Governor's Energy Office

9. "Waste makes want."

- Unknown Author

10. "Recycle paper. Save a tree."

- Mass Chant, Okeechobee, FL.
Saturday, March 7, 1981

ANALOGIES:

1. Highway driving at 70 M.P.H. is like _____

_____.

2. A one-half inch crack under an outside door is like having an 18-inch square in that door.

3. Driving a poorly tuned car is like _____

_____.

4. Unshaded school walls soak up solar heat like _____

_____.

5. How is one energy situation like the "Gift of the Magi?" _____

_____.

6. Using black as a roof color is like _____

_____.

7. Having an uninsulated water heater is like _____

_____

8. Driving a cadillac today is like feeding a _____.

9. High energy consumption is to America as _____.

10. Helping our government to solve the energy crisis is like _____

_____.

11. Flour is to cake as _____ is to solar water heating.

12. Using corn to make gasohol in a hungry world is like _____

_____.

13. Using electricity to heat water is like _____

_____.

14. Interest is to a savings account as _____ is to a solar water heater.

15. Driving with underinflated tires is like _____

_____.

16. Conserving paper is like _____.

17. Failing to insulate your home is like _____

_____.

18. Not fixing a dripping hot water faucet is like _____

_____.

19. Constantly opening your refrigerator is like _____

_____.

20. Letting hot water leak from a faucet is like _____

_____.

21. Heating a house without insulation is like _____

_____.

22. Running a car on low tires is like _____

_____.

23. Using a bulb with too high voltage for your needs is like hitting a fly with a _____.

24. _____is to energy as fish are to mosquito larvae.

25. _____ is to energy as a wolf is to sheep.

MORE COMPLICATED ANALOGIES

1. Burning gasoline to power a car is like _____

_____.

2. Natural gas is to electric power generation as _____ is to _____.

3. 55 M.P.H. speed limits are to saving gasoline as _____ is to _____.

4. Solar energy is to heating water for homes as _____ is to _____.

5. (Gasoline) is to (America) as nicotine is to smokers.

6. (Solar Energy) is to the future as (oil) was to the past.

7. Students are to teachers as _____ are to _____.

8. A raft is to a drowning person as conservation of energy is to _____ _____.

9. Using (electricity) to (heat hot water) is like plowing your garden with a Cadallic El Dorado!

10. Showers are to baths as Ford Escorts are to Lincoln Continentals!

11. Solar energy is to fish in lake eco-systems as solar energy is to _____ _____ in household systems.

12. Putting a solar collector on your roof to heat water is like _____ in the ground to _____.

13. Housepower is to cars as amps are to electric motors.

14. Blazing is to heat loss as (a bottle cap) is to (a coke).

15. Conservation is to energy as (blood) is to (life).

16. Inflation is to prices as (waste) is to (electric bills).

17. Putting a solar collector on your roof to collect solar energy is like drilling holes in the earth to _____.

18. Solar energy is to fish in a lake eco-system as _____ is to people in a household.

19. (crude oil) is to (gasoline) as bauxite is to aluminum.

20. Energy conservation is to _____ as saving is to spending.

21. Using _____ to make electricity is like using skilled teachers to collect lunch money in the cafeteria!

22. Going out in the winter without a coat, is like _____.

23. Recycling aluminum cans is like _____ a bauxite deposit.

24. Geothermal energy is to Western states as _____energy is to Florida.

25. _____windows is like plugging a hole in a dike.

26. Insulation is to a _____as feathers are to a bird.

SCIENCE: 7 & 8th GRADES

LESSON 1

TITLE: Every Day Conservation

CONCEPT: Energy Must Be Conserved

OBJECTIVES:
1. Understand the need to use both natural resources and manufactured products with moderation.
2. Learn ways they can use resources and products wisely and avoid wasting them in their daily life.

INTRODUCING THE LESSON:
1. Place posters or pictures of people conserving or abusing energy (see attached questions).
2. Begin discussion of the pictures -

   How is energy conserved?
   How is energy being wasted?

3. Have students compose a paragraph or list ways they can conserve energy.
4. Discussion of lists and compile ways to conserve.

EXTEND LESSON:
1. Have students bring in articles, pamphlets, booklets, etc., giving further ideas for conserving.
2. Use the "blue box" to calculate how much energy various appliances use. (The "blue box" is available through your Tri-County TEC Office.)
3. Discuss what "E.E.R. Rating" is and how to use these to be a wise consumer.

READING SKILLS:
1. Acquire a basic vocabulary.
2. Determine the cause and effect of events and actions.
3. Determine logical generalizations.
4. Recognize fantasy, fact and opinions.
5. Follow written and oral directions.
6. Use appropriate reference skills.

WRITING SKILLS:

1. Compose grammatically correct sentences.
2. Organize objects and information into logical groupings and order.
3. Write a paragraph expressing ideas correctly, spell correctly, punctuate correctly, capitalize and write legibly.

TAKE JUST WHAT YOU CAN EAT.*

How will this save energy?
Why does the big boy have more on his plate?
Can you make a comparison with cars?
Do you see a lot of people wasting food at school? At home?
How can doing this (take just what you can eat) help conserve energy?

BUS, BIKE, WALK OR CARPOOL!

How does this help energy conservation?
Could you walk or bicycle more?
Does your family own an 8 cylinder car? Or a luxury auto? Or a small car? Or a van, etc.

WRAP IT UP. PUT IT AWAY!

How does this help energy conservation?
Do you know any "rules" or tips on how to save energy in the kitchen? (especially the refridge)
Does it take energy to grow our food?
Do we get energy from our food?

RECYCLING HELPS.

How does it help?
Are bottles better than disposable plastic ones - why or why not?
Are there things other than coke bottles we can recycle?

BE A CAREFUL HEAT USER.

Why?
What is the girl doing to save energy?
What is the suggested temperatures for winter? Summer?
What is the boy doing?
How can that save energy?

*Based on posters: Everyday Conservation by ICM.

THEY'RE YOUR THINGS. TAKE CARE OF THEM.

Why is it a good idea to take care of your belongings?
How was your stuff made? (Took energy to make it, deliver it, purchase it, etc.)
How does taking care of your stuff help energy conservation?

DON'T WASTE WATER.

Why shouldn't we?
Do you think dripping faucets cost you money?
Where does your hot H_2O come from?
How hot is it - out of the tap?
How can you conserve H_2O?
How can H_2O conservation help energy conservation?

LESSON 2

TITLE: Teachers Practice Energy Conservation

CONCEPT: Ways to Conserve Energy

OBJECTIVE: To discover how many people actively conserve energy.

INTRODUCING THE LESSON:
1. Discuss M.P.G. - how it is determined.
2. Ask students their opinions on energy efficient autos.

DEVELOPING THE LESSON:
1. Go out and survey the faculty parking lot.
2. Develop a faculty survey.
3. Discuss findings and pick the most energy conscious teacher; the most energy efficient car; the "gas hog".

EXTEND LESSON:
1. Present awards to that teacher in an assembly - have students present the criteria for awards
2. Do a more complete survey of vehicles looking for more detailed criteria for efficient autos.
3. Do independent surveys using similar criteria at corners downtown, neighborhoods; Okeechobee school facilities to find out if Okeechobee is energy conscious.

READING SKILLS:
1. The student will acquire a basic vocabulary.
2. The student will determine the causes and effects of events and actions.
3. The student will determine the logical generalizations which can be drawn from a message.
4. The student will recognize fantasy, fact and opinion in a message.
5. The student will follow oral and written directions.
6. The student will use appropriate reference skills.

WRITING SKILLS:

1. The student will organize objects and information into logical groupings and orders.
2. The student will write for the purpose of supplying necessary information.
3. The student will correctly spell.
4. The students will punctuate correctly.
5. The students will capitalize correctly.
6. The students will write legibly.

MATH SKILLS:

1. The students will read and write numerals.
2. The students will add whole numbers.
3. The students will divide whole numbers.
4. The students will determine the information needed to solve a problem.
5. The students will interpret graphs, tables, and maps.

ACTIVITY: Take your class out into the teacher parking lot. Complete the survey.

1. How many large cars are present: _____
2. How many small compact cars: _____
3. How many small trucks: _____
4. How many large trucks: _____
5. How many vans: _____
6. How many motorcycles: _____
7. How many bicycles: _____

Total number of vehicles: _____
Total number of employees: _____

Using straight averages: How many people per vehicle? _____

Now, survey the faculty and find out how many people carpool. How many vehicles in the family? How many members in the family? Using the M.P.G. ratings - which car in the lot is the most energy conserving? The biggest gas hog? Which teacher, based on carpooling, and/or M.P.G. ratings, is the "Conservation Person?"

NOTE: How many cars have radial tires? Tinted windows? Air conditioning? 3, 4, or 5 speed transmissions? Automatics? Diesels? Cars 2 or more years old? Number of teachers living out of county? "Souped up" cars? Excessive "junk" in the cars? 4-Wheel drive vehicles? Oversized tires?

Number of foreign cars? _____
Number of domestic cars? _____

LESSON 3

TITLE: How Much Energy Does It Take To Get You To and From School?

CONCEPT: To find out the most energy efficient way of getting students to and from school.

OBJECTIVE: To find out which is more energy efficient: buses or autos.

INTRODUCING THE LESSON:

1. Inform students how many M.P.G. school buses get.
2. Get students opinions on which would be the most efficient (buses or cars) and reasons why.

DEVELOPMENT OF LESSON:

1. Survey students with either Survey A for personal auto or Survey B for bus.
2. Compile results, ranking students by energy usage.
3. Conclude which is the most efficient means of transport.

EXTEND LESSON:

1. Compare diesel, L.P. gas, and gasoline powered buses.
2. Would it be beneficial to the school system to enforce the 2 mile-limit? Why or why not?
3. Develop a carpool plan for those not bussed?

READING SKILLS:

1. Acquire a basic vocabulary.
2. Determine cause and effect of events and actions.
3. Determine logical generalizations.
4. Recognize fantasy, fact and opinion.
5. Follow oral and written directions.
6. Use appropriate reference skills.

WRITING SKILLS:

1. The student will organize objects and information into logical groupings and order.
2. Write for the purpose of supplying necessary information.
3. The student will: spell, punctuate and capitalize correctly.
4. The student will write legibly.

MATH SKILLS:

1. Read and write numerals.
2. Add, multiply and divide.
3. Determine information need to solve problems.
4. Interpret graphs, tables, and maps.

PERSONAL AUTO - ACTIVITY: Are you conserving energy to and from school?

1. Do your parents bring you to school?
2. What kind of car do you have?
3. What is the M.P.G. rating for your car?
4. How many people ride with you to school?
5. How far do you live from schools?
6. How many gallons of gas do you use every day?

BUS

1. Do you ride a bus to school? How many miles?
2. How many students ride on your bus?
3. Is your bus gas powered, L.P. or diesel?
4. How many M.P.G. does your bus get?
5. About how many gallons per student does it take to get you to and from school?

COMPILATION OF DATA

1. Rank each student by how many gallons it takes to get each student to school.
2. Record if they come by Auto (A) or Bus (B).
3. Which is the most energy conserving method of getting to school?

LESSON 4

TITLE: Soil Conservation

CONCEPT: To gain an understanding of how conservation principles and practices will prevent the destruction of natural resources.

OBJECTIVE: Understand and demonstrate principles of soil conservation.

INTRODUCING THE LESSON:

1. Discussion on how the slope of the ground affects erosion.
2. Demonstrate and experiment with different degrees of elevation.
3. Contour planting.
4. How to increase fertility of the soil.

DEVELOPMENT OF LESSON:

1. Stream tables - compare contour, strip planting, and terracing.
2. Note why top soil is important.
3. List ten soil conservation practices.
4. Types of soil.

READING SKILLS:

1. Acquire a basic vocabulary.
2. Determine cause and effect of events.
3. Determine the logical generalizations from a message.
4. Follow oral and written directions.

WRITING SKILLS:

1. Organize objects and information into groupings.
2. Write for the purpose of supplying necessary information.
3. Spell corectly, punctuate, capitalize and write legibly.

LESSON 5

TITLE: Are You and Your Family Environmentally Aware?

CONCEPT: What things are in your home...

OBJECTIVE: To make students aware of articles in their homes and how to become more environmentally aware.

DEVELOPMENT OF LESSON:

1. Send home a survey with each student.
2. Conduct discussion about the impact of results.
3. Develop a plan to do more about environmental problems.

EXTEND LESSON:

1. Try to expand the survey to include the community implications.
2. State implications.
3. National implications.

SAMPLE QUESTIONS:

1. Count the number of beverage containers in your home. How many are reusable?
2. How many different kinds of paper goods do you have in your home?
3. How many kinds of plastic products in your home? (Don't forget packaging materials, plastic wrap, etc.)
4. How much mail do you or your family receive in a week?
5. How many electrical appliances?
6. How many lamps?

The teacher and students should add more questions as appropriate.

READING SKILLS:

1. Determine the causes and effects of actions and events.
2. Determine logical generalizations.
3. Follow written and oral instructions.

SCIENCE: 9th GRADE

LESSON 1

TITLE: Food Chain - Energy Exchange

CONCEPT: As net energy is transformed net energy is lost

OBJECTIVE: To examine the efficiency of net energy exchange in a food chain.

INTRODUCING THE LESSON:

1. Theoretical introduction to food chain (*1).
2. Suggested vocabulary: biomass, food pyramid, population, community, ecosystem, biological magnification, biosphere, ecosphere, predator, prey, consumer, decomposer, producer (*1).

DEVELOPMENT OF LESSON: Food chain lab

1. Materials
   - (a) Plants
   - (b) Herbivore insects
   - (c) Frog
   - (d) Snakes
   - (e) Triple beam balance
   - (f) Terrarium
2. Methods
   - (a) Weigh plant material (*4,5,7)
   - (b) Weigh insect(s) (keep insect(s) separate) (*5)
   - (c) Feed plant material to insect(s)
   - (d) Wait a day
   - (e) Weight insect(s) (*7)
   - (f) Record change in biomass of each insect (*2,6)
   - (g) Weigh frog(s) (Keep frogs separate)
   - (h) Feed insect(s) to frog(s)
   - (i) Wait a day
   - (j) Weigh frog(s)
   - (k) Record change in biomass of each frog (*2,6)
   - (l) Weigh snake (weigh snake plus bag; weigh bag) (*7)
   - (m) Feed frog(s) to snake
   - (n) Wait a day
   - (o) Weigh snake (*7)
   - (p) Record change in biomass (*2,6)
   - (q) Analyze data (*5,9)
   - (r) Make conclusions. about change in biomass as you move the food chain (*3)

EXTEND LESSON:

1. Culture organisms.
2. Collect data over extended period of time.
3. Supply theoretical data if lab fails.
4. Have students weigh their food and themselves. (measure change in their own biomass)
5. Change organism in food charge and see if there is an increase in efficiency.

LESSON 2

TITLE: Plant: A Solar Energy Collector

CONCEPT: Plants are solar energy collectors

OBJECTIVE: To discover the similarities between plants and solar energy collectors.

INTRODUCING THE LESSON:
1. Theoretical introduction to plants (morphology and photosynthesis).
2. Theoretical introduction to solar energy collectors (*1).

DEVELOPMENT OF LESSON:
1. Lab (Solar Energy Collector) (*4).
   (a) Materials
      1. Box
      2. Saran wrap
      3. Thermometer
      4. Aluminum foil
      5. Cup
      6. Water
      7. Paper
   (b) Methods
      1. Have students build their own solar energy collector (*7).
      2. Have students measure temperature change in water with time. (Have a control - one collector blocked from sun.)
      3. Note: Amount of energy absorded depends on surface area; amount of energy absorbed depends on angular relationship between sun and surface area.
      4. Record date (*5).
      5. Analyze data (*9).
      6. Conclusion.
2. Lab with plant.
   (a) Materials
      1. Sun flower plant
      2. Yard stick
      3. Paper
      4. Box
   (b) Methods.
      1. Grow sun flower plant (2 or 3 weeks ahead of time).
      2. Draw circle around plant.
      3. Note position of plant's shadow in circle.
      4. Place box over one of the growing plants (used as a control).
      5. Record data (*5).
      6. Analyze data (*9).
      7. Conclusion.
3. Compare plant to solar energy collector.
   (a) Solar energy collector stores energy; plants store energy.
   (b) Collectors' position has to be changed to absorb sunlight efficiently. Plants leaves change positions.
   (c) Collectors surface area important. Surface area of leaf important.

EXTEND LESSON:
1. Collect data over period of time.
2. Using filters over plants and solar energy collectors.

*Skill Number - Find skills on page 32.

LESSON 3

TITLE: Algae as an Alternative Energy Source.

CONCEPT: As our current energy sources are depleted, algae may be an important supplemetn to our food and fuel supply.

OBJECTIVE: To explore methods such as culturing, harvesting, and processing algae for food and fuel through projects and research.

INTRODUCING THE LESSON:

1. Theoretical introduction to algae (*1).
2. Observing algae.
   (a) Collected algae
      1. Microscope
      2. Gross observation
   (b) Algae in natural surroundings
      1. Aquarium
      2. Pond
      3. Ocean

DEVELOPMENT OF LESSON (*4):

1. Culture algae (unbalanced aquarium).
   (a) Source of energy (c) stock culture
   (b) Source of nutrients (d) Fresh or salt water
2. Harvesting algae.
   (a) Collecting
   (b) Washing
3. Processing (*5,8).
   (a) Determine wet weight
   (b) Divide crop in half
   (c) Types of processing
      1. Food Processing (use 1/2 of crop) (*5,7).
         (a) Dry algae
         (b) Weigh algae
         (c) Grind algae
         (d) Weigh algae (ground)
         (e) Compare dry weight with wet weight
         (f) Use supplement to make biscuit (do not eat)
      2. Fuel processing (use 1/2 of crop).
         (a) Place algae in Erlenmeyer Flask
         (b) Seal flask with rubber stopper and tube
         (c) Place in dark place.

EXTEND LESSON:

1. Display algal food stuffs.
2. Display algal byproducts (iodine, etc.).
3. Use of commercial prepared algal flour and make edible biscuit (*3).
4. Can other animals eat algae (*3)?
5. Show net energy food chain relationship (*2,5,9).
6. How can methane fuel be used (*3)?
7. Can you burn algal chips (*3)?
8. Measure light energy needed to produce algae and compare to amount of biomass (*2,5,9).

*Skill Number - Find skills on page 32.

LESSON 4

TITLE: Exponential Growth

CONCEPT: Populations are limited by the resources of food and energy available.

OBJECTIVE: The use of bacteria to demonstrate that the requirement for energy resources increases dramatically as exponential growth occurs.

INTRODUCING THE LESSON:

1. Theoretical explanation of doubling time and its consequences (*1).
2. Point out that recent statistical studies of human population growth are comparable to bacterial growth in the presence of unlimited media.

DEVELOPMENT OF LESSON:

1. Culture bacteria (*4).
   (a) Inoculate media with swab of a classroom surface area.
   (b) Incubate.
2. Make daily classroom observations.

EXTEND LESSON:

1. Discuss population cycle (*2).
2. Discuss examples of the dramatic effects of exponential growth or classic doubling examples.
3. Discuss reason for giving away pet offspring a limiting factor (*3).
4. If offspring are kept what additional demands on food, time space would they make (*3).
5. Use as examples of limiting factors present in elephant, deer, lemming populations, etc., (*3).
6. Discuss or observe effects of other limiting factors on bacterial growth, i.e., sunlight or temperature.
7. Observe visible changes in media.

LESSON 5

TITLE: Obtaining Energy: Adaptations to Sources of Energy

CONCEPT: Animals utilize many methods to make the most of available energy sources.

OBJECTIVE: To understand relationship between beak or moth shape to food source.

INTRODUCING THE LESSON:

1. Bring in bird pictures emphasizing beak shape and function (*3,4).
2. Relate to food source: What do they eat? How do they get to their food supply?

DEVELOPMENT OF LESSON:

1. Bring in series of fish mouth pictures. Let students match shape to function and food source (*3,4).
2. Bring in mammal mouth pictures. Let students match shape to food source.

EXTEND LESSON:

1. Ask what energy sources other than food are important to man (*3,4).
2. Describe environmental situation where a human group is living (example - desert, by a swift river, windy coast, fault zone, etc.).
3. How could the group best adapt to resources to meet energy needs? (Situations can include easy access too wood, geothermal, coal, oil, natural gas, and so forth). The class could also give examples to show in appropriate group actions to meet needs.

BASIC SKILLS
(As cited in the lessons *)

READING SKILLS:

1. Students will acquire a basic vocabulary as determined by a specified word list.
2. Student will determine cause and effect of events and actions.
3. Students will determine logical general rations.
4. Students will follow oral and written directions.

MATH SKILLS:

5. Students will read and write numerals.
6. Students will subtract whole numbers.
7. Students will measure weight.
8. Students will divide whole numbers.
9. Students will interpret graphs and tables.

SOCIAL STUDIES: 6th Grade

LESSON 1

TITLE: Energy Sources

CONCEPT: Students will be able to recognize the difference between a primary source of energy and a secondary source of energy source such as electricity. They need to make this distinction to realize that without some primary energy source the production of electricity and many other products would be impossible.

Develop a time line from 1776 to the present including background on water, wind, fossil fuels, nuclear and solar energy.

OBJECTIVES: Students should be able to:

1. List the various forms of energy.
2. To become aware of primary energy sources.
3. Finish time line to become familiar with the history of energy resources and their development.
4. Understand the basic workings of energy sources.
5. Analyse their own energy consumption in relation to the four sectors of use and become aware of their own stake in our energy problems.

INTRODUCING THE LESSON: Discuss forms of energy and how we have used them through the course of history.

DEVELOPMENT OF LESSON: Activity Master 1, 2, 3, 4.

1. Distribute copies of the time line.
2. Have students follow the sequence of events that resulted in the formation of energy sources.
3. Students will perform simple research to complete statements on a timeline covering 200 years of energy development.

EXTEND LESSON:

1. Encourage students to search for energy-related stories in newspapers and magazines to bring to class.
2. Start a class energy bulletin board.
3. Current events on energy consumption in their lives.

COUNTY OBJECTIVES RELATED SKILLS: B9, F4, F5, L3, K6, G5.

READING SKILLS:

1. Context clues - finds who, what, where, when, which, and how information.
2. Order of details in a selection; cuase and effect of an action.
3. Follows written directions to complete a task.
4. Identifies an appropriate source to obtain information.

MATH SKILLS:

1. Read and determine relationships by graphs. (X3)

From: The Energy Challenge, Washington, D. C.: U. S. Department of Energy, 1980, 2nd Edition.

Finish the Energy Timeline

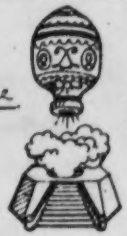
Activity Master 1

cut

1780 1785 1790 1795

1776
In England James Watt puts two engines to work in factories & starts an energy revolution. The energy is steam.

1783
Two men fly in a balloon at Paris, France. The energy used is hot air.

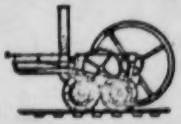


Most people burn wood for heating and cooking and travel by horse or on foot.

1800
In Italy, Volta invents the battery and gives his name to the volt. The energy produced is electricity.

cut

1800 1805 1810 1815 1820 1825



1804
An Englishman, Richard Trevithick, puts James Watt's engine on wheels and rails. He is the father of the railroad locomotive.

1807
Robert Fulton doesn't build the very first steamboat, but he makes the one people first pay to ride on.

Wood continues to supply most household energy needs. But coal begins to do more in factories and railroad engines.

1821
First attempt to develop and market natural gas near Fredonia, N.Y.

cut

1830 1835 1840 1845

1829 An American named Joseph Henry and an Englishman named Michael Faraday each invents a generator. Who is first? Henry. The energy produced? electricity

1837 Americans put new inventions to work. First comes McCormick's reaper, then the steam shovel by Otis, and the telegraph by Morse.

Railroads expand rapidly, hauling freight and passengers brave enough to stand the jolts and to risk hot cinders that often fly from the engine into their cars. England is first and America second in railroad locomotive production.

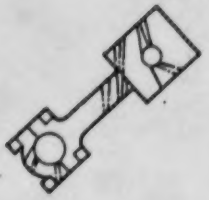
cut

1850 1855 1860 1865 1870 1875

38

1859
Edwin Drake strikes oil in Pennsylvania beginning the petroleum industry.

1860
Lenoir of France invents the internal combustion engine.



An explosion inside a cylinder paves the way for the later invention of the automobile. An oil strike hastens the discovery of the fuel that will run it.

cut

38

cut

1880 1885 1890 1895

Coal and wood still furnish most of the energy in homes. Coal-fired "iron horses" (railroads) — and real horses — continue to take most people places. Although the electric bulb has been invented most people still use kerosene or gaslights to read by.

1884
In England, Charles Parsons perfects the steam turbine and advances the development of electrical energy.

1886
Karl Benz builds the 1st successful automobile.

1892
The oil-burning engine is invented by Rudolf Diesel. Eventually, this engine will replace steam-powered ones.

1895
The power of Niagara Fall is harnessed to make electricity.

cut

1900 1905 1910 1915 1920 1925

1903
The engine in the Wright brothers' plane is powered by gasoline

1905 Albert Einstein develops a theory for measuring energy and prepares the way for the atomic age.

1910
Ford makes the first Model T car.

By the end of this period, many new homes have coal furnaces in the basement. And more and more cars appear in garages.

cut

1930 1935 1940 1945

1926
Robert Goddard tests a rocket

1936
Hoover Dam on the Colorado River is built to generate hydroelectric power.

1940
Nylon, a fiber made from oil, coal, and water makes its first public appearance.

1942
In Chicago, Enrico Fermi sets off the first nuclear chain reaction.

Many homes convert from coal to natural gas for heating. Most families own at least one car and some have two.

cut

1950 1955 1960 1965 1970 1980

1952
Bell scientists raise hope for our energy future with the solar battery.

1957
The U.S. gets its first big nuclear electric power plant at Shippingport, Pa.

Demands for energy grow. America gets more people, more homes, more factories and businesses, more cars, more trucks, more buses, more planes. Demand grows faster than supply.

1970
Congress passes the Clean Air Act.

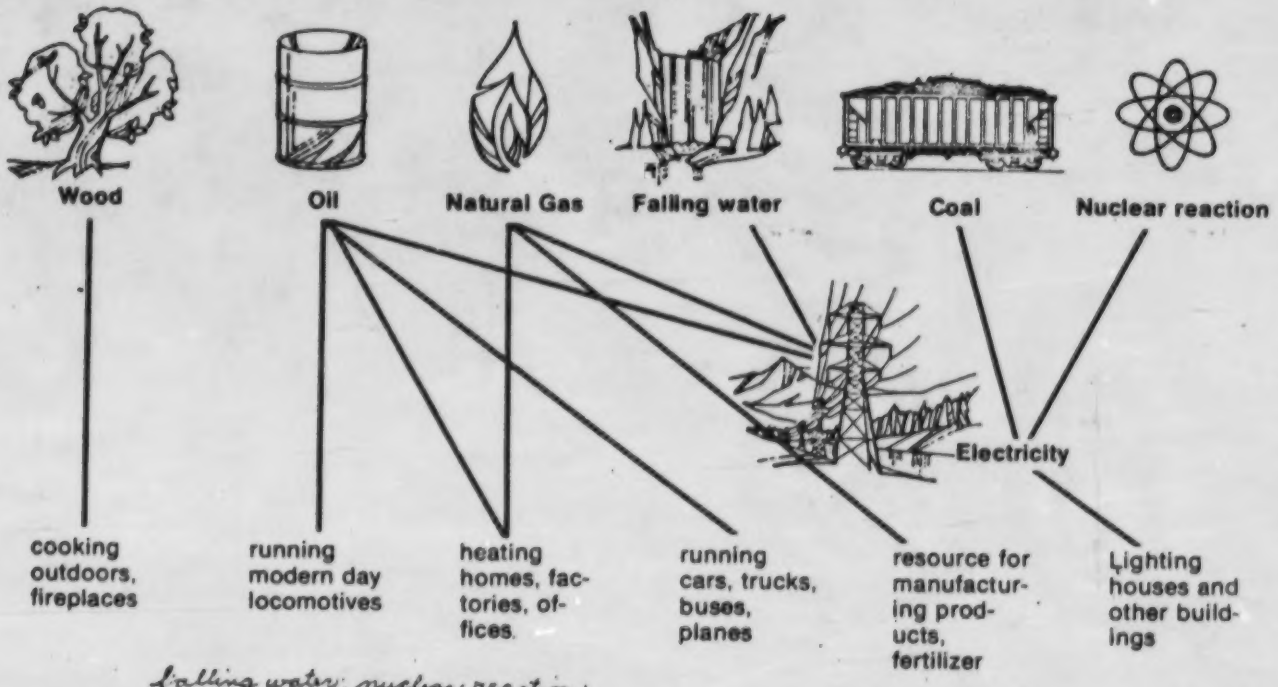
1973
OPEC nations embargo oil and produce an energy crisis.

1980 Americans continue to look for ways to conserve the energy we have and find new energy sources.

cut

Activity Master 3

Primary Energy Sources



falling water; nuclear reaction

The diagram above shows six *primary sources* of energy. Lines connect each primary energy source to the most important work it does. Which energy source is seldom used today? Which two do not involve burning to produce power? Which ones are used to make electricity? oil; natural gas; water; coal; nuclear.

Use the information on the chart and on the energy timeline to help you complete these four stories about the Spritz family.

1. In 1901, Great-grandma and Great-grandpa Spritz went by train to Niagara Falls for their honeymoon. The train engine burned coal to boil the water that made the steam that drove it. The *primary* source of energy was coal. Not long ago their great-grandchildren flew by jet to California. The primary energy source that got them there was oil.

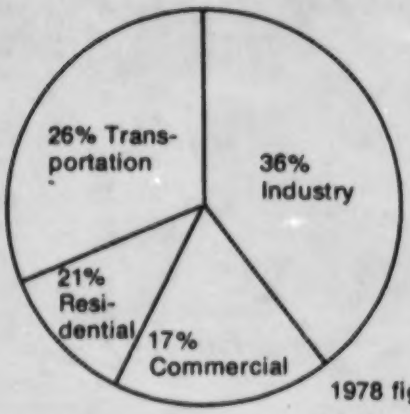
2. Great-grandpa Spritz was one of the first in town to drive an automobile. His Model T burned gasoline. The primary source of this fuel is oil. A Spritz great-grandson earns his living driving a big diesel truck. The primary source of this fuel is oil.

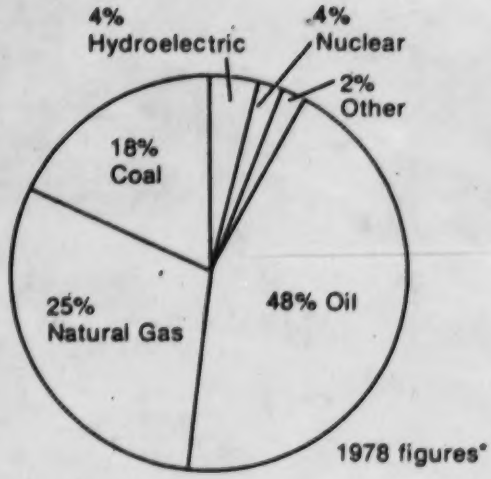
3. Four generations of Spritzes have lived in the old family home. At the turn of the century, the family huddled around a stove in the parlor for warmth. Probably the primary energy source was coal or wood. In 1928 the family put in central heating by installing a furnace in the basement. The primary energy source was coal. Since 1952 the Spritzes, like most Americans, have heated their homes with a primary energy source that is clean and convenient to use. It is natural gas.

4. Recently a young Spritz asked how the electricity that lights the house and runs the appliances is made. His dad drew a picture of a giant wheel with blades. "This is a turbine engine," he said. "There are a number of these at our city's power plant. These giant wheels turn to make electric energy. Falling water or powerful blasts of steam turn the wheels. You can't get steam, of course, without boiling water. And so a primary energy source furnishes heat to boil the water." The primary energy source that makes most of our electricity is coal. Other sources might be oil or natural gas or nuclear fuel.

Activity Master 4

Where We Get Our Energy How We Use It





GRAPH A

Graph A divides our energy use into four groups. In what group do we use the most energy? transportation
What ranks second? transportation
In what ways do you use energy in each of these two groups? What group(s) gives you the most opportunity to cut down on your energy consumption?

Which groups use energy when you do each of the following. Check the box or boxes in the appropriate columns.

(The first one is done for you.)

Every item that includes a product could also be checked under "Industry."

	Industry	Transportation	Commercial	Residential
1. Take a hot bath				✓
2. Drive to a hamburger stand		✓	(✓)	
3. Fly in an airplane		✓		
4. Switch on air-conditioning	✓			✓
5. Buy a new baseball			✓	
6. Ride a school bus		✓		
7. Blow dry your hair at home				✓
8. Buy a frozen pizza			✓	
9. Ride a motor-bike		✓		
10. Manufacture a motor-bike	✓			

GRAPH B

Graph B shows five primary sources of energy. These five sources supply Americans with most of their energy needs. They light and heat the buildings in which we live, work, and play. They fuel our vehicles. They run the machines that work for us and manufacture and process the goods we use and the foods we eat. Look at Graph B and answer these questions.

**Numbers may not total 100% because of rounding.*

1. What energy source do we use most? oil

2. Which do we use mostly for heating our homes? natural gas

3. What energy source provides most of the fuel for our transportation? oil

4. Which one makes most of our electricity? coal

5. What is a possible reason why we use so little hydroelectric energy? not very much fast moving water

6. Why is electricity not shown on this chart? it is a secondary source.

LESSON 2

OBJECTIVE: F5 - Determine the order of details in a selection.

Read the following selection and discuss the main idea or topic sentences of each paragraph.

TROUBLE AT BRAVO 14

The men at Bravo 14 oil well, off the coast of Norway in the North Sea, discovered that a gauge they had lowered into the well had become stuck, partly blocking the flow of oil.

To get the gauge out, they knew they had to shut down the well. None of the roustabouts liked doing this job. It could be dangerous; it was always tricky.

The roustabouts began working around the clock pumping tons of heavy drilling mud into the pipe. The mud was supposed to block the flow of oil. When it stopped, they could then take out the valves at the wellhead and get the stuck gauge out.

Harris, the roustabout other crew members called the "Old Man" because he had worked on oil rigs for many years, was the first one to see mud leaking from the pipe. "Get outa here," yelled Harris. His voice rose even higher with his second warning, "She's a runaway!" The crew ran for their lives.

Bravo 14 turned into a geyser of hot, red-brown crude oil shooting two hundred feet into the air. It gushed for a week, pouring five million gallons of crude oil into the ocean, and making an oil slick 36 miles long and 32 miles wide. The oil slick was headed for the seashores of Europe.

Newspapers carried long stories about the runaway oil well, and Bravo 14 soon became a familiar name. In several stories, newspaper reporters explained the cause of the blowout. It seems that when the roustabouts thought the mud had done its job, they began to remove the valves. And to be extra safe, they put in a blowout preventer over the open wellhead. But they put the preventer in upside down. They had gotten only two bolts fastened when Bravo 14 blew.

Each day the roustabouts tried to cap the well. And each day they failed.

Finally Red Adair himself was called in. He and his crew of two men, Boots and Toots, have put out oil fires and capped gushers all over the world. At Bravo 14, Red, Boots and Toots, wearing their red flameproof suits, waded into the roaring oil and water.

Working with speed and care, they installed a pair of steel rams around the spurting wellhead. Then they backed out and turned on the power. The rams slipped smoothly forward and pinched the pipe shut. The geyser stopped.

"Not a real big job," said Adair to reporters later. "What we call a medium big job."

"Where to next, Red?" asked a reporter.

"There's a well on fire in Arabia. I'm heading there now. It might be a tough one, though."

He winked at the reporters when he said that.

* * * * *

New Vocabulary

gauge: an instrument for testing the pressure or flow of oil.

roustabouts: the men working on the well.

valves: mechanical instruments used to start and stop flow through the pipes.

wellhead: the equipment at the top of the pipe.

blowout preventer: a machine to plug a well in an emergency to prevent the flow of oil or gas.

geyser: a spray of oil, or gas or water that shoots into the air from beneath the earth's surface, caused by pressure.

runaway well: an uncontrollable well.

rams: huge clamps used on oil pipes.

LESSON 3

Student Worksheet: Red's Next Job

C5: Write a story about Red's next job. Use as many new vocabulary words as you can. Use the space below for your story.

E5: Determine the main idea stated in a paragraph.

F5: The order of details in a selection.

READING SKILLS:

Objective F5: Read to determine the order of details.
F4: Who, what, when, how.
E5: Main idea of selection.

March 19, 1978

The Wreck of the AMOCO CADIZ

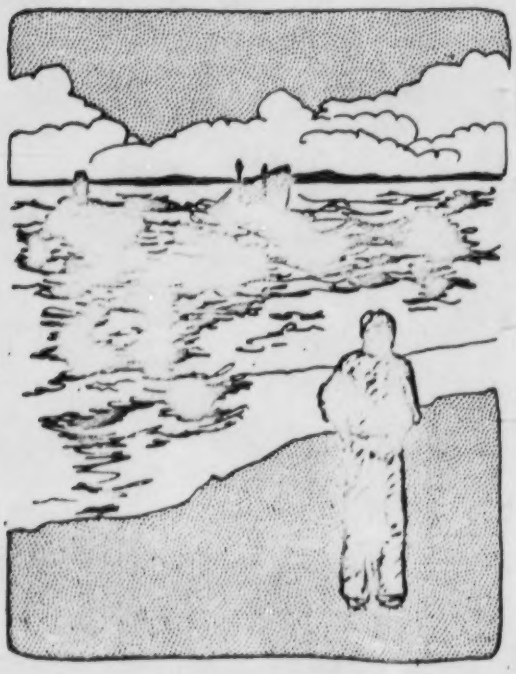
Supertanker Breaks Apart Off Coast Of Northern France

The people of France are cleaning up after the fourth major tanker wreck off the coast of Brittany in eleven years.

On March 16, 1978 the *Amoco Cadiz*, carrying 230,000 tons (over 70 million gallons) of light crude oil from the Middle East ran aground when the captain ordered the engines stopped after the ship's steering mechanism jammed.

Rough seas prevented other ships in the area from unloading the oil before the *Amoco Cadiz* broke in two in the shallow waters off the French coast.

French government officials are meeting to decide how to prevent further shoreline damages. The French Navy has been instructed to enforce an order preventing tankers from passing within seven miles of the coast.



Shoreline Impact of an Oil Spill

I think I noticed him standing there on the beach simply because he was the only person not moving quickly around. Everyone else seemed to be lifting something, or brushing something, or hauling buckets of things to some place away from the edge of the sea. He stood, still and quiet, his feet buried in hundreds of thousands of dead sea snails, his right hand touching clusters of periwinkles dying on nearby rocks. I saw him reach down to lift one tiny snail out of the blackened pile, and watched him try to brush away the oil with the sleeve of his sweater. Then I saw him drop the snail among its dead and dying brothers and turn with angry eyes toward the sea.

There in the mist, looking like some broken-backed sea monster, lay the supertanker, *Amoco Cadiz*, dead among the restless waves. Its cargo of oil spread mile upon mild across the waves. Here

on the shoreline the oil coated everything it touched with a thick, black ooze.

The man was a marine biologist. It is his job to help assess the damage to sea life in this region and to keep a record of its recovery from the spillage of sixty-six million gallons of crude oil. He knows the effects will be major and varied. To his relief there has been no gigantic fish kill reported. But oysters and other shell fish will have to be measured carefully to find out when the levels of petroleum hydrocarbons will go down enough to make them edible again.

He saw beaches as far away as sixty-five miles from the spill paved with dead sea urchins, razor clams, and dead snails. Now he is especially interested in finding out how much damage has been done to seaweed and kelp.

The people of Brittany in Northern France farm the sea like they do the land. They raise and harvest seaweed as we do wheat and corn and use it for medicines, food, and fertilizer. The biologist is sure that this year's crop is surely ruined. What, he wondered, will happen if the reproductive cells of seaweed have been ruined as well. How could new colonies of these important seaweeds get started again?

Early scientific data tend to show that sea birds have been harmed by the oil. Over 5,000 dead birds were found along the shore, and hundreds more are struggling for life in makeshift bird hospitals. But the outlook for these oil-soaked birds is grim. Oil and sea birds simply don't mix.

Sea birds have thick feathers. This thickness provides almost perfect insulation from cold water. Oil destroys the structure of the feathers and exposes the bird's skin to freezing water. In addition, the bird loses much of its ability to float as the layer of air trapped between body and feathers disappears. As a result the bird rides lower in the water, and most likely can no longer feed itself.

If the bird does not die of starvation, it will sooner or later die from exposure. But the creature may float around for days, its heart beating in double time to compensate for the heat loss. Perhaps the end will be hastened by swallowing some of the oil, which acts like a poison.

But what if a bird is rescued, what are its chances? The biologist would have to shake his head. Bird rescues have not had much success in the past. Most rescue operations work in the same way--with the same poor results. First the bird is cleaned with mineral oil, and then the feathers air dried. However, the bird's delicate system does not recover quickly enough, and very few birds survive the cleaning and captivity.

The biologist began to worry that clean-up techniques for beaches as well as the birds might be doing more damage to the ecosystem than oil itself. For example, will steam hosing and brush cleaning of rocks and sand cause a whole new set of biological problems to set in?

It will be a long time before the shore will return to normal. For the present and for the near future, the cost to the people and to plant and animal life of Brittany has been immense.

Student Worksheet: <u>Understanding</u>

1. Circle the sentence which describes the marine biologist's job.

2. Underline the names of plants and animals that have been damaged or killed by the oil.

3. Circle twice the sentences which describe the possible long-term damage to important seaweeds.

4. How are sea birds harmed by oil?

5. Write the sentence that tells how the people of Brittany use seaweeds.

6. The second paragraph in the news story mentions why the ship went aground. What was the reason?

7. How much oil was the tankership carrying?

8. How did the French government decide to attack the problem of tanker oil spills damaging their shoreline in the future?

9. How might more problems arise from clean-up operations after the oil spill?

10. Describe what you think people were lifting, brushing or hauling to safer places on the beach.

Things Being Lifted

Things Being Brushed

Probably Being Hauled Away

LESSON 4

OBJECTIVE: Students will discover for themselves some of the benefits and problems of eight new energy resources.

1. Current events.
2. Research for reports.
3. Debate - facts and opinions.
4. Role play of pros and cons of the energy problems.

Other New Energy Resources

Besides nuclear and solar energy, there are several other possibilities for the future. Read about some of these new energy sources on this page. Problems and solutions are associated with each of them. On the next page you will decide what some of these problems and solutions are.

WIND. Wind is actually a form of solar energy since it is caused by variations in the temperature of the air heated by the sun that causes air to move. Sailors used this energy for ages. For many years farms have used windmills to generate electricity. Maybe giant windmills will someday be able to provide electricity for entire towns. The major difficulties are that the wind doesn't blow all the time and that practical storage systems are still being developed.

GEOTHERMAL. The earth's center is a molten mass. In some areas this mass is close to the surface. Some evidence of this are volcanos, geysers, and hot springs. This heat can be trapped and used to generate electricity to supply cities without polluting the atmosphere. The problem is that this energy can now be tapped only where it is near the surface. Scientists are searching for other areas where this geothermal energy can be reached, but they don't have all the answers yet.

PYROLYSIS OF SOLID WASTE. It is possible to heat waste in an oxygen-free atmosphere and produce oil and gaseous products. This waste is what we're now having trouble removing from our environment: manure, garbage, paper, logging residue, some industrial waste, sewage, and the like. The difficulty is that this material tends to be scattered in small amounts at various sites. The problem is one of gathering it together at a reasonable cost.

COAL GASIFICATION. By using high temperature and pressure, coal can be converted into a gas very much like natural gas. Building these conversion plants near coal fields can solve the problem of transporting bulky fuel that gives off pollutants when it is burned. When coal gas is burned, it burns as cleanly as natural gas, causing virtually no air pollution. The usual pollution problems occur in the coal mining process, however, as they always have. The conversion process itself, however, uses large amounts of electrical energy.

COAL LIQUEFACTION. Although the technology is not completely developed, coal can be converted to an oil-like liquid. It has the advantage over coal gas of being usable to make all the usual oil products, including a kind of gasoline to run our cars.

OIL SHALE. Oil shale is a rock containing a material that yields oil when it is crushed and heated. One ton of rock will produce about 25 gallons of oil. Most oil shale deposits are in the West. The rock must be mined, either by deep mining or surface mining. Extracting the oil takes large amounts of water — three barrels to every one barrel of oil processed. One of the big problems is the disposal of the spent rock after the oil is extracted. Vegetation will not grow on the used shale without a moderate amount of rain — scarce in many parts of the West. Without vegetation, some animals may lose their homes and natural food supply. Rain water passing through this rock will possibly pick up pollutants and carry them to larger bodies of water if there is no vegetation. In addition, oil shale processing contributes to air pollution.

Problems/Solutions

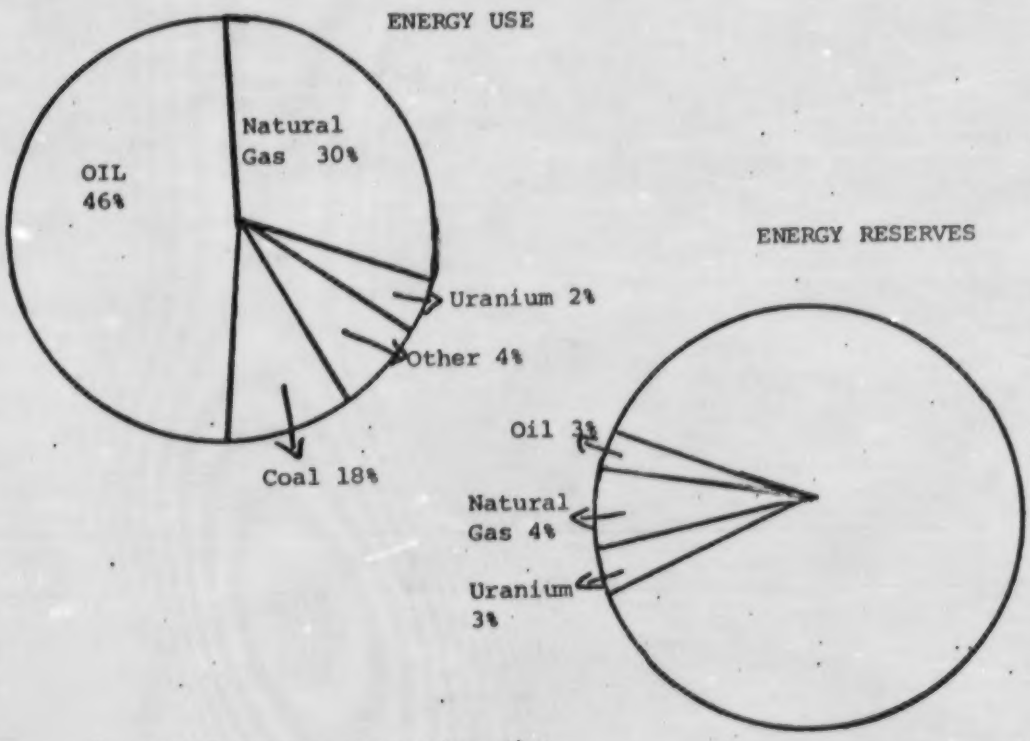
In this unit, you have learned about eight new energy resources. The use of any one of these resources may help to supply our energy requirements but may at the same time present us with new problems to consider. In the lefthand column of this page are some of these issues — some are problems, some are solutions. Mark each statement S (for solution) or P (for problem). Place a checkmark in every energy-resource column on the right to which a statement applies. The first one is done for you.

	IF THIS ENERGY SOURCE IS USED, IT . . .	SOLAR	NUCLEAR	WIND	GEO-THERMAL	COAL GASI-FICATION	COAL LIQUI-FACTION	OIL SHALE	PYROL-YSIS
S	WOULD HELP SOLVE THE PROBLEM OF SOLID WASTE DISPOSAL.	✓		✓	✓	✓	✓		✓
P	COULD POLLUTE WATER.		✓		✓			✓	
S	WOULD CONSERVE THE DWINDLING RESERVES OF FOSSIL FUELS.	✓	✓	✓	✓				✓
P	COULD DAMAGE WILDLIFE OR THEIR HABITAT.		✓		✓	✓	✓	✓	
P	WOULD BE DIFFICULT TO STORE AND TRANSPORT.	✓	✓	✓					
S	WOULD NOT POLLUTE THE ATMOSPHERE.	✓		✓					
P	WOULD DISRUPT THE NATURAL USE OF LAND SURFACES.		✓		✓	✓	✓	✓	
P	WOULD NOT BE ABLE TO SUPPLY ENERGY ALL THE TIME.	✓		✓					
P	WOULD HAVE TO WAIT UNTIL THE TECHNOLOGY IS DEVELOPED.	✓		✓	✓	✓	✓		
P	WOULD USE LOTS OF WATER TO PROCESS.		✓					✓	
S	WILL DECREASE THE NEED FOR OIL IMPORTS.	✓	✓	✓	✓	✓	✓	✓	✓
P	WILL MAKE LARGE AMOUNTS OF WASTE MATERIAL.							✓	
S	WILL MAKE USE OF THIS COUNTRY'S MOST ABUNDANT FOSSIL FUEL.					✓	✓		

LESSON 5

OBJECTIVE: To learn the relative amounts of reserves and use of various energy sources.

X3



1. Which energy source has the most reserves? _____

2. What percent of the total is this source? _____

3. Which energy source is used the most? _____

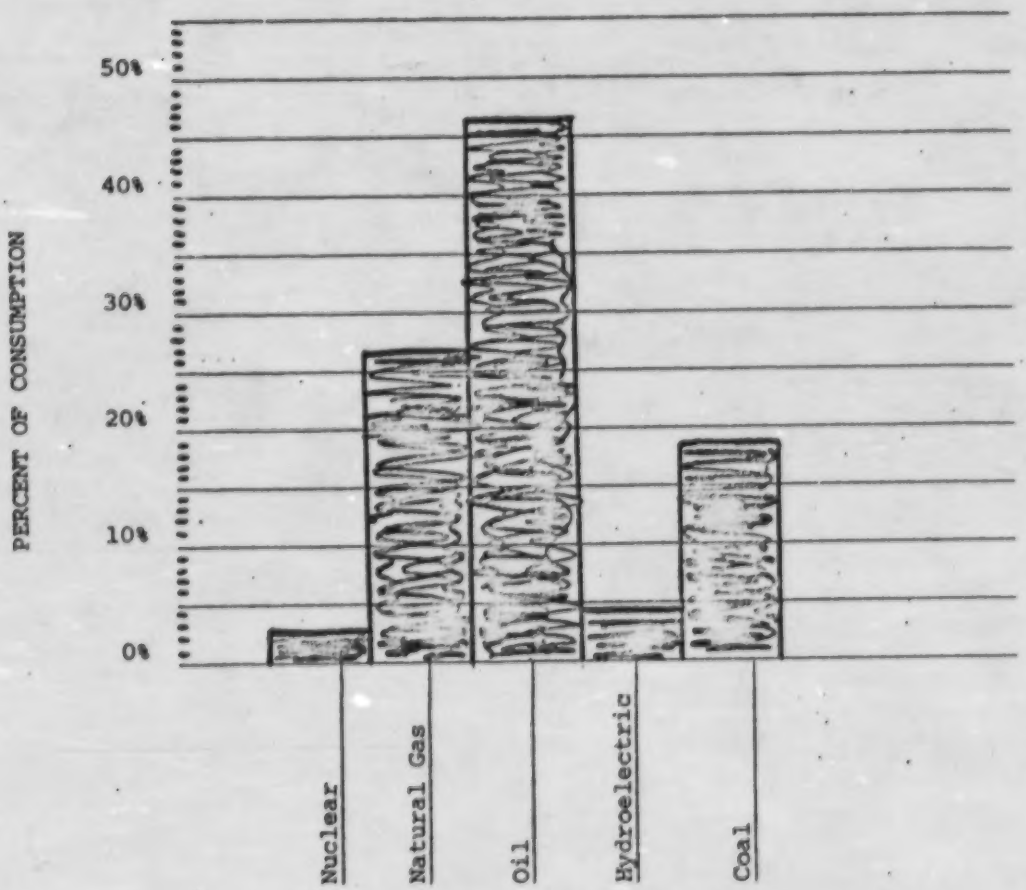
4. What percent of the total use is coal? _____

5. List other energy sources. (Examples: sun, wind, water, geothermal)

LESSON 6

X3 Read and determine relationships described by bar graphs.

U.S. Energy Consumption Graph



1. What type of energy do we use the least of?
2. The U. S. consumes 19% of which source of energy?
3. Which of the bars on the graph are over 25%?
4. What type of energy do we use the most of?
5. Which bar is approximately 5%?

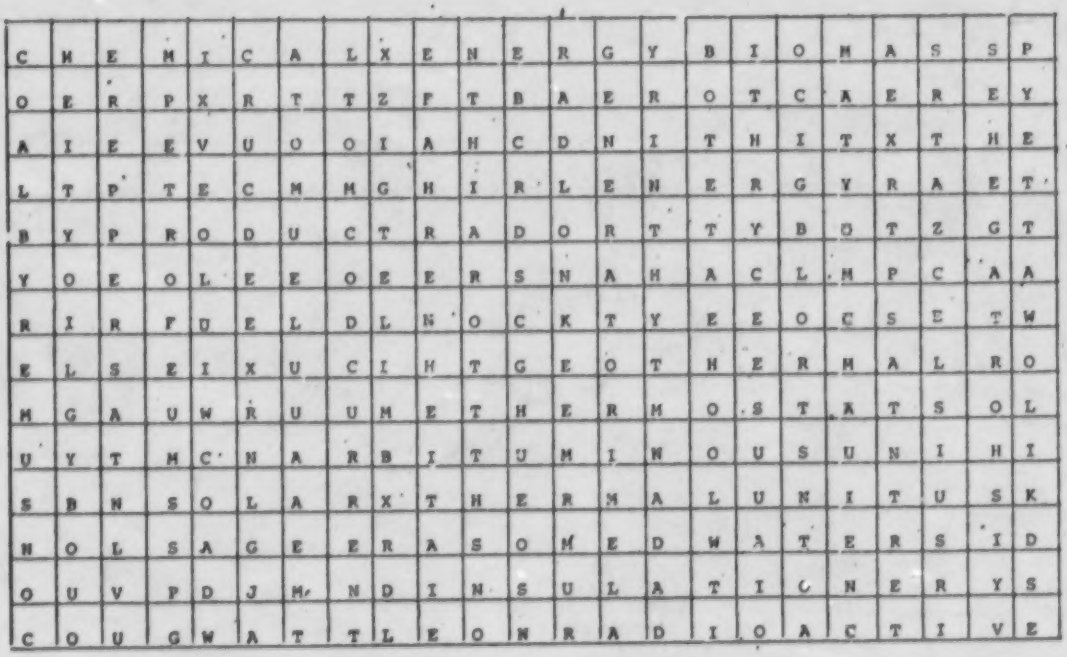
Mastery: 4 out of 5.

LANGUAGE ARTS: 6th GRADE

1. Role play.
2. Short stories.
3. Letter writing.
4. Paragraphs - dealing with energy uses and types.
5. Read a paragraph; circle all the plural forms of nouns.
6. List information before writing.
7. Write a paragraph expressing ideas clearly.
   Direction: Write a paragraph telling more about this topic.

   "Energy Conservation is a major concern for our future"

8. Outlining.
9. Complete a check and its stub.
10. Write a set of simple directions or procedures using an appropriate organizational pattern.
11. Poetry.



C	H	E	M	I	C	A	L	X	E	N	E	R	G	Y	B	I	O	M	A	S	S	P
O	E	R	P	X	R	T	T	Z	F	T	B	A	E	R	O	T	C	A	E	R	E	Y
A	I	E	E	V	U	O	O	I	A	H	C	D	N	I	T	H	I	T	X	T	H	E
L	T	P	T	E	C	M	M	G	H	I	R	L	E	N	E	R	G	Y	R	A	E	T
B	Y	P	R	O	D	U	C	T	R	A	D	O	R	T	T	Y	B	O	T	Z	G	T
Y	O	E	O	L	E	E	O	E	E	R	S	N	A	H	A	C	L	H	P	C	A	A
R	I	R	F	U	E	L	D	L	N	O	C	K	T	Y	E	E	O	C	S	E	T	W
E	L	S	E	I	X	U	C	I	H	T	G	E	O	T	H	E	R	M	A	L	R	O
M	G	A	U	W	R	U	U	M	E	T	H	E	R	M	O	S	T	A	T	S	O	L
U	Y	T	M	C	N	A	R	B	I	T	U	M	I	N	O	U	S	U	N	I	H	I
S	B	N	S	O	L	A	R	X	T	H	E	R	M	A	L	U	N	I	T	U	S	K
N	O	L	S	A	G	E	E	R	A	S	O	M	E	D	W	A	T	E	R	S	I	D
O	U	V	P	D	J	M	N	D	I	N	S	U	L	A	T	I	O	N	E	R	Y	S
C	O	U	G	W	A	T	T	L	E	O	N	R	A	D	I	O	A	C	T	I	V	E

There are 30 terms in the letter puzzle above which deals with energy. Circle each.

Chemical Energy	Gas	Radioactive	Current	Sun
Thermal Unit	Current	Solar	bituminous	Celsius
Crude	By Product	Watt	Fahrenheit	Generator
Oil	Insulation	Voltage	Energy	
	Consumer	Reactor	Heat	
Fuel	Thermostat	Coal	Kilowatt	
Atom	Shortage	Biomass	Nuclear	

SEQUENCING CARDS OR PICTURES

PURPOSE: Sequence

1. Cut pictures in a sequence and place them in envelopes.
2. The students must unscramble the order to put the pictures in correct sequence.
3. Read a story and number the events in sequence.

USEFUL WORDS: Become familiar with them. Each word is used in a sentence. After the sample sentence, there is a line for you to write your own sentence using the new word.

1. Benefits ben-e-fits; job advantages or payments other than salary.

   When offered a job, you should ask what benefits are available.

2. Energy
3. Electricity
4. Anemometer
5. Consumer
6. Nuclear
7. Solar
8. Fusion
9. Atom
10. Reactor

Which one doesn't fit?

Each line in the list below has five words. Four of the words are somehow related. One word does not belong. Circle the letter of the word that does not belong.

1. (a) meter (b) electric (c) lights (d) fumes

2. (a) flame)b) persistence (c) fire (d) blaze (e) combustion

3. (a) sun (b) heat (c) radiant energy (d) insulation

4. (a) insulation (b) fuel (c) coolant (d) heat resistant

5. (a) oil (b) nuclear energy (c) thermostat (d) cool

The look of words:

Each line in the list contains a familiar word. But, the word is spelled four different ways. Circle the letter next to the correct spelling. Write the word, spelled correctly, on the line at the right.

1. (a) hazerdous (b) hazardus (c) hazardous hazardous

2. (a) carefull (b) carful (c) careful careful

3. (a) fossil (b) fosil (c) fossell (d) fosel _____

4. (a) inergy (b) energy (c) enurgy (d) inurgy _____

5. (a) neclear (b) neclere (c) neclair (d) nuclear _____

6. (a) fishion (b) fission (c) fussion (d) fashion _____

7. (a) combustion (b) cumbusion (c) conbustion (d) combestion _____

8. (a) insolation (b) enselation (c) insultion (d) insulation _____

9. (a) generetor (b) ginerator (c) generator (d) genitor _____

10. (a) solear (b) solar (c) selor (d) solair _____

HOW BIG ARE THEY?

Objectives B15, Math
F5, Reading

The companies listed below are among the world's largest profucers of petroleum. The center column shows each company's sales for a recent business year. In the right-hand column, rank these companies from the largest to the smallest. Write the name of the company and its number from the left-hand column. Use a piece of scrap paper to help you get organized. The first one is done for you.

Adams Oil Company	$ 12,600,000	1. _____
Zeco Oil & Refinery	59,731,000	2. _____
Acme Oil Company	421,884,000	3. _____
Dry Pump Oil Company	3,741,000	4. _____
Dig Deeper Oil Company	21,000,000	5. _____
Waste Less Oil Company	5,620,000	6. _____
Black Gold Oil Company	13,927,000	7. _____
Jed Clampit Oil Company	1,984,659,000	8. _____
Bozo's Oil Company	449,209,000	9. _____
T & G Oil Company	2,432,802,000	10. _____
Okeechobee Oil Company	17,116,000	11. _____
Crisco Oil Company	93,296,000	12. _____
Joe's Oil Company	821,756,280	13. _____
Peter Pump Oil Company	5,432,000	14. _____
Armpit Oil Company	251,928,000	15. _____
Leaking Valve Oil Company	32,964,000	16. _____
Usemore Oil Company	23,970,000	17. _____
Black Rock Oil Company	152,051,000	18. _____
Ocean Oil Company	796,945,000	19. _____

ANTONYMS: A35

An antonym is a word that means the opposite of another word. Example: Hard - soft. Below are two columns of words. For each word in the left-hand column there is an antonym in the right-hand column. Match the correct antonymn with each word in the left-hand column. Write the antonym and its letter in the center columns.

1.	Heat	___ _____	a.	Waste
2.	Combustible	___ _____	b.	Losses
3.	Mechanical	___ _____	c.	Harmless
4.	Assets	___ _____	d.	Unstable
5.	Hazardous	___ _____	e.	non-combustible
6.	solid	___ _____	f.	cleanliness
7.	conservation	___ _____	g.	cool
8.	fossil fuel	___ _____	h.	atomic (nuclear)
9.	stable	___ _____	i.	liquid
10.	polluter	___ _____	j.	electrical

EXPRESS YOUR EXPERIENCE IN POETRY

A cinquain is a five line stanza of poetry. Look around you on your way to school tomorrow. Compose a cinquain about something you saw that deals with energy.

Here's how:

1. Write one word, the subject. _____
2. Write two words that describe the subject (what it looks or feels or sounds like). _____ _____
3. Write three action words about it (what it is doing, has done, or will do). _____ _____ _____
4. Write four or five words about your feelings for it, or someone else's feelings for it.

   _____ _____ _____ _____ _____
5. Write one word that means the same thing as your subject (synonym). _____

Example

Ocean
Gray Rough
Smashing, crashing, roaring
I'm half afraid of you
Sea.

WORLD GEOGRAPHY: 7th GRADE

LESSON 1

TITLE: Energy in the World

Students will identify the increasing role and importance of energy resources in the world.

MATERIALS:
Yarn
Newspapers
World map (political)
Bulletin board
Index cards

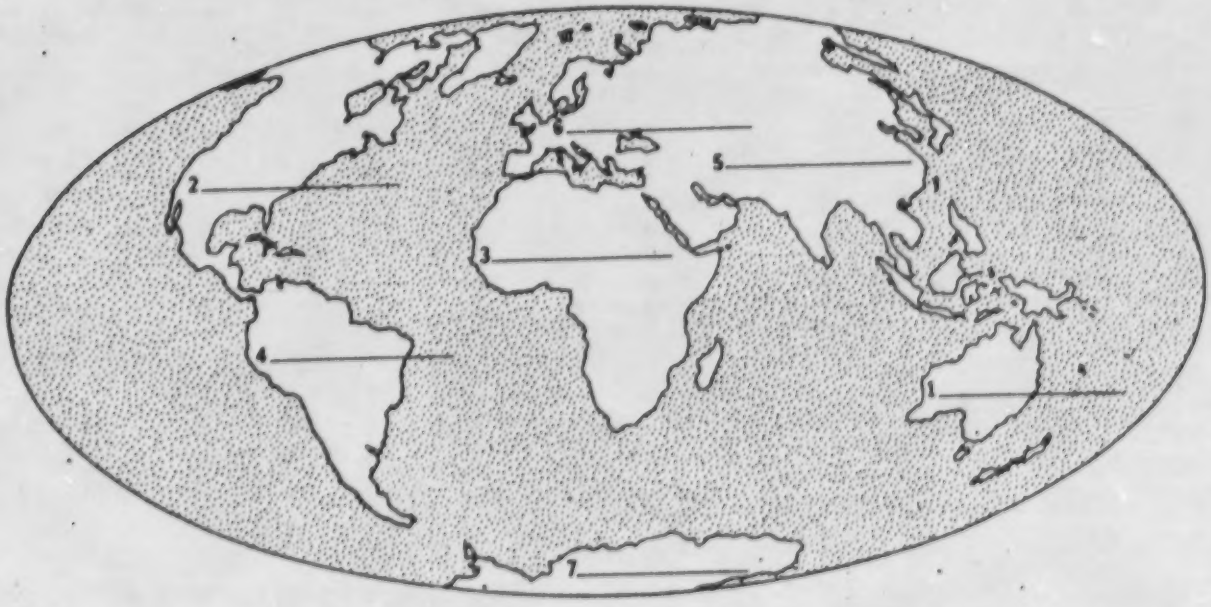
Students will select from current news sources articles concerning energy. The student will identify the following information about the article:

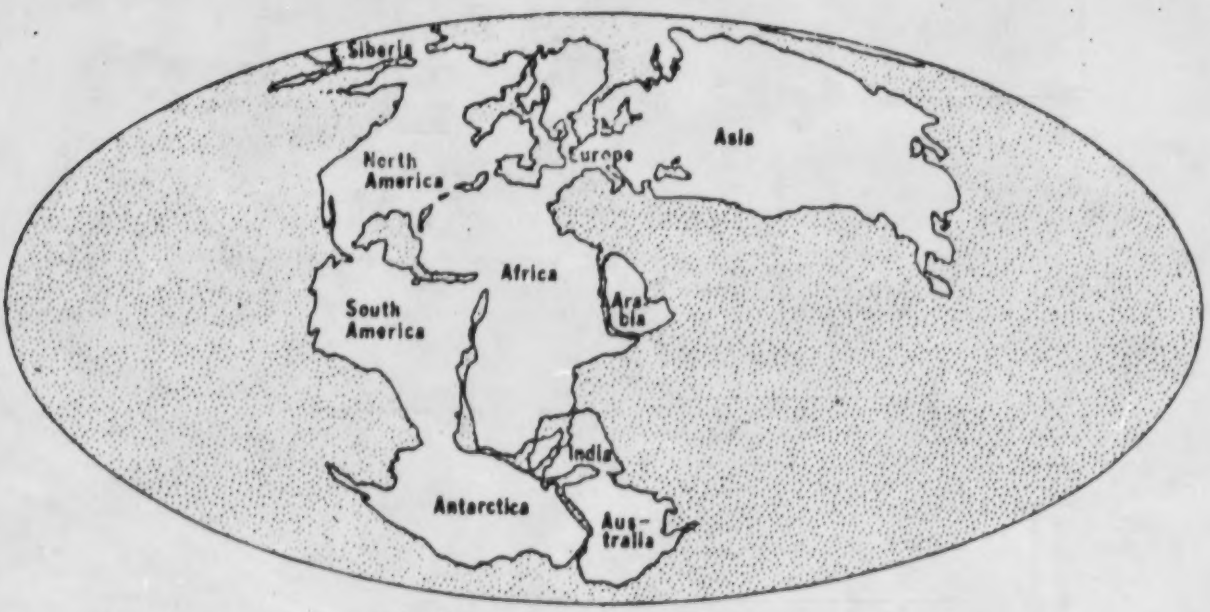
1. Location (geographic-political)
2. Energy source involved
3. Reason (main point) of the article

Student will make a short presentation about the article then place the card on the bulletin board. The yarn is then placed from the card to the country or region on the map.

Map 1

The World As It Is Today





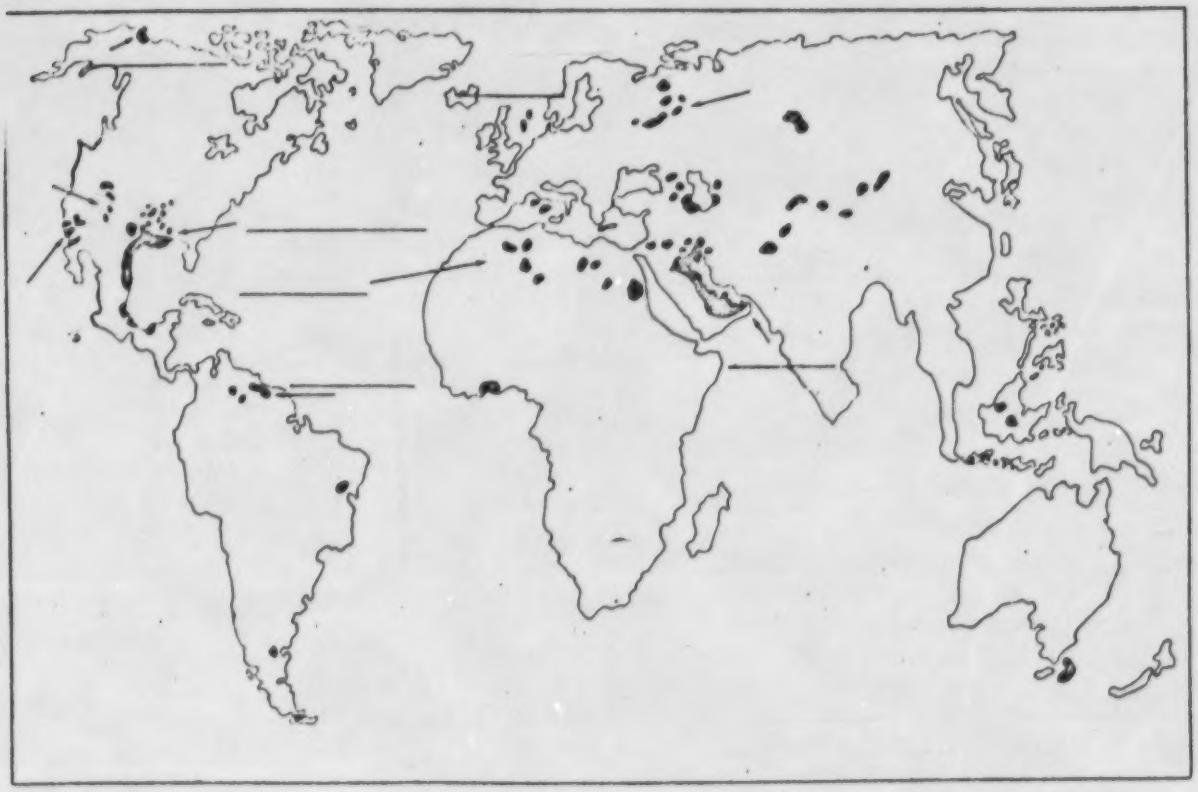
Map 2

The World 150 Million Years Ago

Map 3

World Ocean Current Patterns

Map 4:
Major Oil Accumulations



The map above shows where major oil accumulations exist. Can you name these places? Put the letters GM where you see the Gulf of Mexico; LM for Lake Maracaibo (Venezuela); AL, Algeria and Libya; PG, Persian Gulf; NS, North Sea; PB, Prudhoe Bay (Alaska).

Use an atlas to check your answers.

NOTE: All maps and charts are from the National Science Teachers Association "Project For An Energy Enriched Curriculum," John M. Fowler, Director. Non-copyrighted.

LESSON 2

TITLE: Falling Fuel

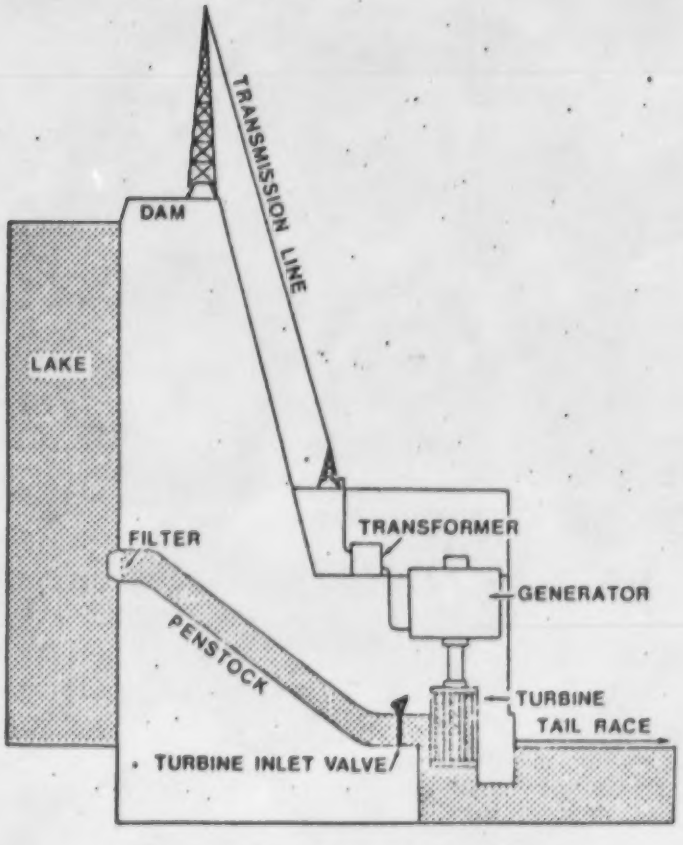
OBJECTIVE: List the items or steps necessary for performing a necessary process.

DEVELOPMENT OF LESSON:

1. What are some of the sources of fuels used to make electricity?
2. Can moving water be considered a fuel to produce electricity? Why or why not?
3. What is electricity called when it is made from falling water?
4. Using the diagram of the Akosombo Dam, identify the part of the dam.
5. Trace the flow from the lake to electricity going out the transmission line explaining what happens at each point.
6. Where would be the best topographic conditions to build a hydroelectric dam? The worst conditions to build one?
7. Should we build a dam to produce electricity on every river in Florida? The United States? Why or why not?
8. What are some points which must be considered in picking a dam site and building a dam?

Lesson 2
Drawing 1

Akosombo Dam in Ghana



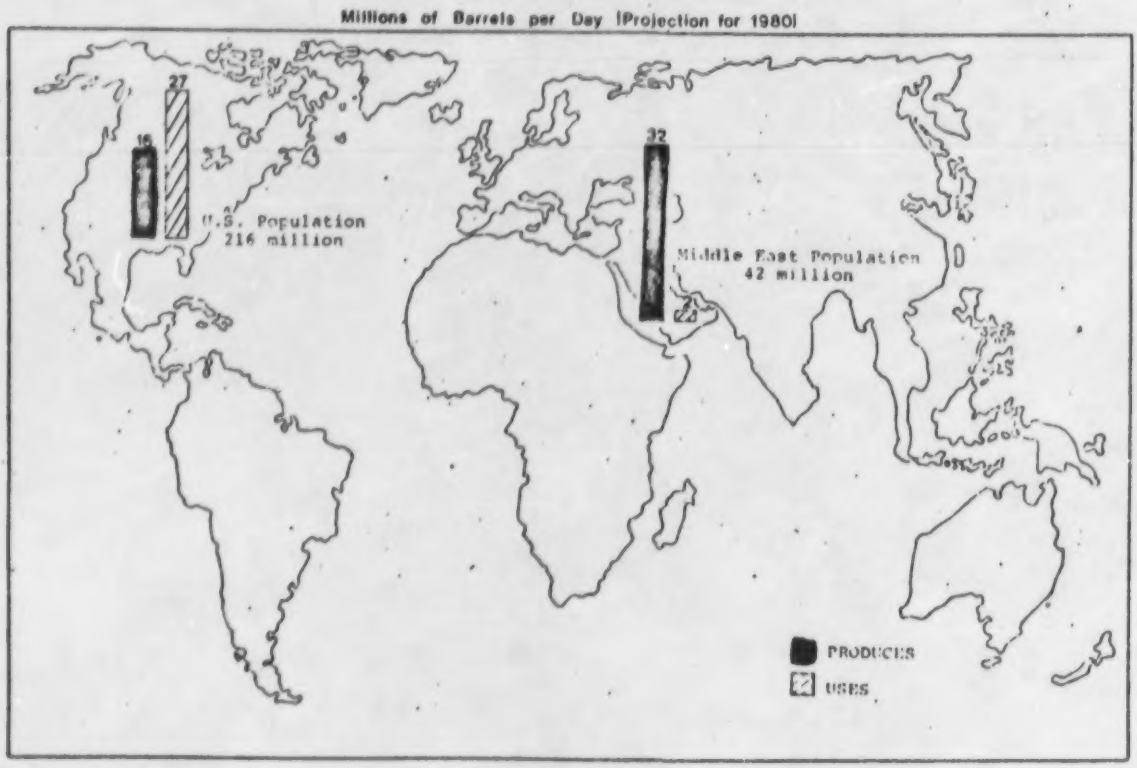
LESSON 3

CONCEPT: Identify an appropriate conclusion based on available data.

DEVELOPMENT OF LESSON:

1. Show a map of on and off shore drilling in Florida.
2. Inform directly or through research the amount of oil produced in Florida daily. (5.4 million gallons, but declining each year).
3. How much oil does Florida use each day? (28.2 million gallons)
4. How many gallons of oil does Florida import each day? Each year?
5. What are some of the ways Floridians consume oil?
6. What might happen in Florida if the country(ies) we import oil from stopped sending it?
7. How do you think it would effect the way Floridians live?
8. Option - have students in groups or individually research alternatives to the use of oil. (coal and nuclear energy, solar energy, etc.)

ALTERNATIVE LESSON: Same procedure as above except substitute map of world showing oil production, U.S. and Middle East production.



AS IT WAS AND AS IT IS!

CONCEPT: The student will determine the causes and effects of events and actions.

DEVELOPMENT OF LESSON:

1. Student will identify the continents.
   Materials: (a) Map of the world (outline)
   (b) Names of the seven continents
2. Student to be given map based on the Continental Drift Theory and on the theorized current patterns.
3. Class discussion of Continental Drift Theory-film-Continental Drift Theory.
4. Student will be given a map showing current oil reserves given selected areas to identify, the student will use an atlas to correctly label each area.
5. Students will complete the following worksheet.

WORKSHEET:

1. What is a continent?
2. How many continents are there? Name them.
3. Looking at the continents' shape and location, how did the earth look 150 million years ago?
4. The energy source shown on map #4 is _____.
5. Which two areas appear to have the largest deposits of oil?
6. What are some of the uses for oil?
7. Do you think the ancient ocean current had anything to do with today's oil deposits?

LESSON 4

AMERICA: AN "ENERGY MONSTER?"

CONCEPT: Consumption is not directly related to income.

OBJECTIVE(S): The student will determine logical generalizations which can be drawn from a chart.

INTRODUCING OF LESSON: Have the students answer the following questions:

1. How many television sets are in your home?
2. How many are color sets?
3. How many electric appliances do you have in your kitchen (toaster, regrigerator, etc.)
4. Is you home air conditioned?
5. How many and what kind of cars and/or trucks does your family have?

DEVELOPMENT OF LESSON:

1. Discussion of questions answered; use the greenboard to tabulate results.
2. How do you think this compares with the rest of the world in the amount of energy consumed against the money needed to purchase the items?
3. Pass out chart on per capita income and annual energy units per capita.
4. Discussion and any necessary explanation of chart.
5. Student will use chart to answer the following questions:
   (a) Rank 3 nations which have the highest per capita income.
   (b) Rank the 3 nations which have the highest use of energy.
   (c) Do the countries rank the same for per capita income and annual energy units per capita?
   (d) In one sentence, write a generalization based on your answers for questions (a) thru (c) and state one fact which you feel supports your statement.
   (e) Class discussion of generalization: list sample statements on the greenboard with facts to support.

Why Some Nations Use More Energy

Country	H,M,L	1974 Per Capita Income* (in U.S. Dollars)	H,M,L	Annual Energy Units Per Capita**
Afghanistan	.....	81.	.....	23.
Argentina	.....	1246.	.....	1490.
Brazil	.....	750.	.....	435.
Canada	.....	5372.	.....	7870.
Egypt	.....	259.	.....	241.
Ethiopia	.....	83.	.....	34.
France	.....	4851.	.....	3314.
Haiti	.....	143.	.....	24.
India	.....	117.	.....	157.
Iran	.....	762.	.....	865.
Japan	.....	3812.	.....	2755.
Laos	.....	100.	.....	71.
Mali	.....	73.	.....	21.
Pakistan	.....	126.	.....	68.
Saudi Arabia	.....	1299.	.....	813.
Sweden	.....	6155.	.....	5140.
Switzerland	.....	6346.	.....	3015.
United States	.....	6155.	.....	9500.
USSR	.....	Not Available	.....	3825.

*The total value of the goods and services produced in a country divided by the total population. (GNP/ Total Population)

**Units refer to energy consumption in barrels of crude oil equivalent per person.

FROM: Energy in the Global Marketplace, Page 49.

LESSON 5

WHY OIL FROM THE MIDDLE EAST?

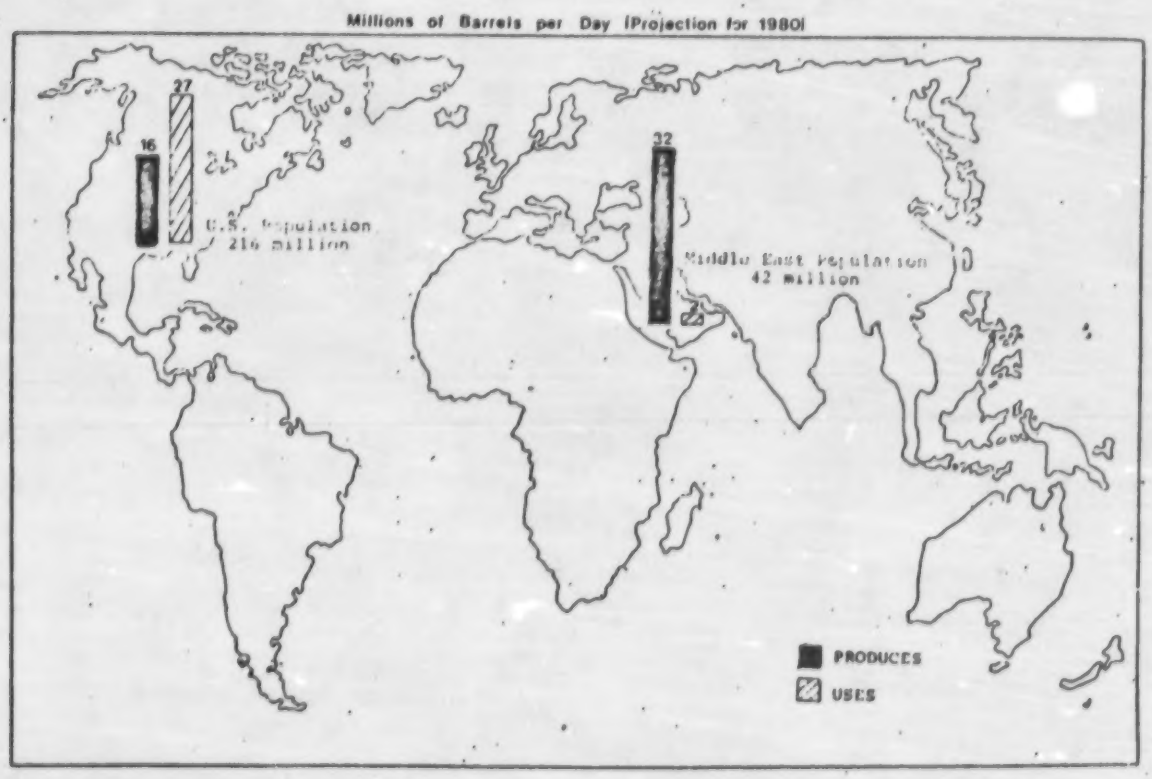
CONCEPT: The accessibility of oil affects its price.

OBJECTIVE(S):
1. Locate Middle East area on a map.
2. Define the terms gross and net.
3. Consider the consequences of actual price.

INTRODUCTION OF LESSON:
1. Show various pictures of working oil fields in the U.S. Oil fields in the U.S. have long since met their peak production. Since the U.S. is an industrial nation, it found it necessary to search for new oil sources.
2. Show pictures of Middle East leaders and U.S. pipelines in the Middle East. The U.S. has turned to the rich oil fields of the Middle East.
3. Locate the Middle East region on a world map. Show the distance between the U.S. and the Middle East region.

DEVELOPMENT OF LESSON:

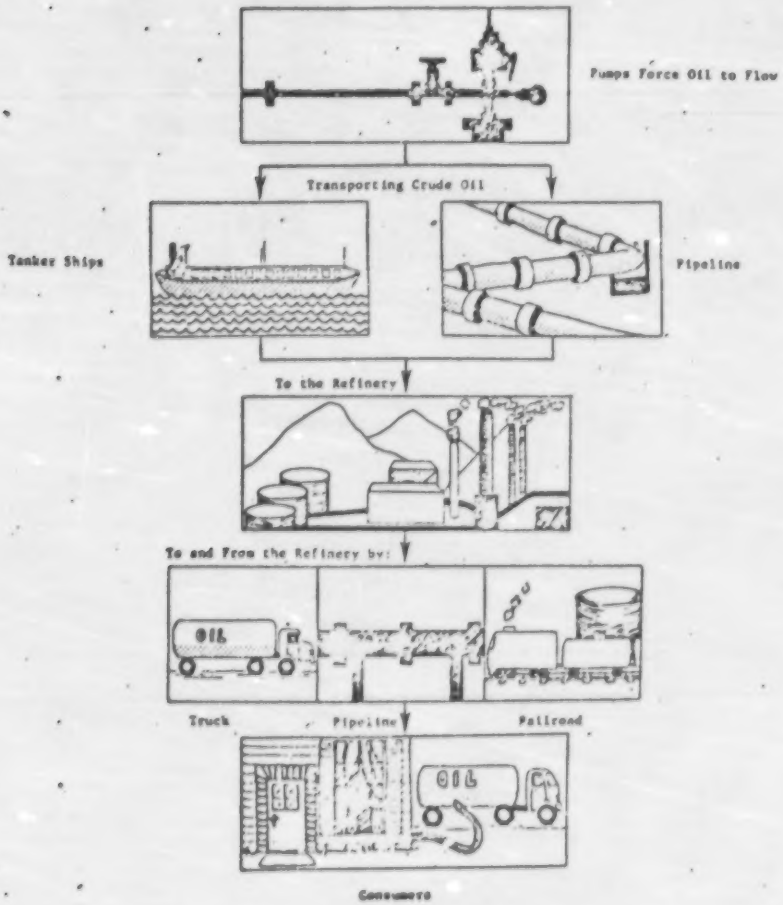
1. Make the statement: "The U.S. consumes more oil than it produces." Pass out graph map.
2. Write the question on the board: "Why do we get oil in the Middle East?" (Allow students to form their own answers. Write them on the board.)
3. Take several current commercials on television which suggest we are working to become oil independent: i.e., Bob Hope talking of Texaco taking oil from shale.
4. Ask the question: "Why have these new systems failed?" (Record answers on the board.)
5. Pass out a check stub showing the gross and net. Give the definitions of these terms. Show the items subtracted from the gross pay (taxes, union fees, social security, retirement fee, insurance, etc.) "You made the gross, but you received the net." (If questions remain of gross/net concept, use step 6.)
6. (Optional) Use handout on "Breaking the Food
7. Take the gross of oil produced in the Middle East. (Use map graph in step 1.) Form a formula similar to below. Total (Gross) 32 million barrels per day - (amount used in the Middle East plus cost of transportation plus fee to refine) equals net oil. Explain that the oil in the Middle East is more readily accessible than in the U.S. Shale oil experts say 600,000,000,000 barrels of oil are locked in shale. Gross (600 billion) - (expense of getting fuel from shale plus transportation fee) equals net.
8. Conclusion - net of the Middle East should be more fficient.



STUDENT WORKSHEET: Where Does Oil Stack Up?

Look at the map, Millions of Barrels per Day (Projection for 1980). Then answer the questions.

1. Does the United States produce as much oil as the Middle East?
2. Which uses more oil--the United States or the Middle East?
3. Which has more people--the United States or the Middle East?
4. Which probably uses all the oil it produces--the United States or Middle East?
5. Which probably cannot use all their oil?
6. If you had more of something than you could use, what would you probably do with the extra?



SOCIAL STUDIES-AMERICAN HISTORY: 8th GRADE

LESSON 1

OIL-BASED PRODUCTS

CONCEPT: People use oil to produce synthetic materials.

OBJECTIVE: To discuss the relationship of oil to the petro chemical industry.

SKILL: To identify luxuries and necessities.

INTRODUCING THE LESSON:

1. Give the students a list of oil-based products.
2. Have the students list them as to necessity or luxury.
3. Tell the students there has been an oil shortage and they must limit production of oil based products. Students are to pick out the ten items they could not live without.
4. Discuss the use of crude oil by the petro chemical industry. State 5% of oil supply to produce the chemicals needed for the manufacturing of synthetics.

EXTEND LESSON:

1. Investigate the substitutes for these and other products - wood, leather, cotton, wool, oil, etc.

Oil-Based Products

antenna cable
credit cards
permanent-press clothes
heart valves
crayons
disposable diapers
parachutes
telephones
enamel
transparent tape
vinyl siding
safety flares
bubble bath
bookends
deodorant
panty hose
bedspreads
plastic tubs
shag rugs
lunch boxes
jerseys
windshield wipers
phonographs
car sound insulation
garment bags
fences
kitchen counter tops
pillows
dune buggy bodies
checkers
soap dishes
syringes
shoes
volley balls
sleeping bags
electrician's tape
mascara
flags
oxygen masks
ink
hair spray
steering wheels
food wrap
rubber duckies
duct tape

card tables
ping pong paddles
purses
weed killers
football pads
puzzles
carbon paper
dishdrainers
puppets
upholstery
hearing aids
earphones
whistles
clothesline
carpet sweepers
chess boards
yardsticks
slip covers
patio screens
mats
refrigerator linings
floor wax
panelling
earrings
false eyelashes
no-wax floors
golf balls
lighter fluid
attache cases
wet suits
laxatives
trash cans
bras
acrylic paints
vacuum bottles
bearing grease
rafts
sockets
tiles
air-conditioners
wallets
backpacks
rubbing alcohol
epoxy glue
oil filters

mailboxes
uniforms
pacifiers
cassette tapes
luggage
antifreeze
flashlights
motorcycle helmets
antibiotics
shower doors
sugar bowls
decoys
tobacco pouches
pencils
model cars
garden hoses
lawn sprinklers
playing cards
dolls
bubble gum
coasters
straps
tires
rulers
boat covers
unbreakable dishes
toothpaste
tents
finger paints
glycerin
foot pads
lamps
ice cube trays
swimming pool liners
cough syrup
hair dryers
styrofoam coolers
brake fluid
draperies
car battery cases
hockey pucks
fertilizers
knitting yarn
sandwich bags
tablecloths
toothbrushes
notebooks
darts
flea collars
stadium cushions
hang gliders
sandals
lipstick
electric blankets

lamp shades
skateboard wheels
guitar strings
jugs
eyeglasses
vinyl tops
TV cabinets
measuring tape
water softeners
microfilm
tennis balls
measuring cups
dishwashing liquid
extension cords
combs
plastic varnish
badminton birdies
bird feeders
hair curlers
laminates
visors
tennis rackets
canisters
computer tape
ammonia
gaskets
monkey bars
venetian blinds
digital clocks
life jackets
model planes
insect repellent
fishing net
hair coloring
rubber cement

LESSON 2

ENERGY OVERVIEW

CONCEPT: To become familiar with energy through the ages.

OBJECTIVE(S): Students will become familiar with the history of energy resource development over the last 200 years.

INTRODUCING THE LESSON:

1. Explain to the students that energy resources has become a central concern in the U.S.
2. Ask questions and discuss
   (a) How does our standard of living place demands on energy resources?
   (b) How have you been made aware that energy is a problem? (brown outs, gas lines, peanut butter)
   (c) Would it be realistic to turn back to the "good old days?"
   (d) What would be a way we can help overcome energy problems?
3. Introduce vocabulary.
   (a) Combustion, energy, generator, steam, turbine
4. Hand out worksheet on time lines.
5. Students will work in groups in the library to complete the activity.

EXTEND LESSON:

1. Students will select one inventor, scientist or invention from the time to write a page on.

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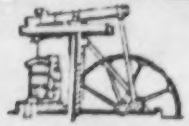
Finish the Energy Timeline

cut

1780 1785 1790 1795



1776
In England James Watt puts two engines to work in factories & starts an energy revolution. The energy is _____

1783
Two men fly in a balloon at _____
The energy used is _____

Most people burn wood for heating and cooking and travel by horse or on foot.

1800
In Italy, _____ invents the battery and gives his name to the volt. The energy produced is _____

cut

1800 1805 1810 1815 1820 1825

1804
An Englishman, Richard _____, puts James Watt's engine on wheels and rails. He is the father of the railroad locomotive.

1807
Robert Fulton doesn't build the very first _____, but he makes the one people first pay to ride on.

Wood continues to supply most household energy needs. But coal begins to do more in factories and railroad engines.

1821
First attempt to develop and market natural gas near Fredonia, N.Y.

cut

1830 1835 1840 1845

1829 An American named _____ and an Englishman named _____ each invents a generator. Who is first? _____ The energy produced? _____

1837 Americans put new inventions to work. First comes McCormick's _____, then the steam shovel by _____, and the telegraph by _____.

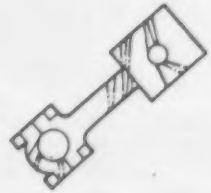
Railroads expand rapidly, hauling freight and passengers brave enough to stand the jolts and to risk hot cinders that often fly from the engine into their cars. England is first and America second in railroad locomotive production.

cut

1850 1855 1860 1865 1870 1875

1859
Edwin Drake strikes oil in Pennsylvania beginning the _____ industry.

1860
Lenoir of France invents the _____ combustion engine.



An explosion inside a cylinder paves the way for the later invention of the automobile. An oil strike hastens the discovery of the fuel that will run it.

cut

cut

1860 1870 1880 1890 1895

Coal and wood still furnish most of the energy in homes. Coal-fired "iron horses" (railroads) — and real horses — continue to take most people places. Although the electric bulb has been invented most people still use kerosene or gaslights to read by.

1884
In England, Charles Parsons perfects the steam _____ and advances the development of electrical energy.

1886
Karl _____ builds the 1st successful automobile.

1892
The oil-burning engine is invented by _____ Eventually, this engine will replace steam-powered ones.

1895
The power of Niagara Fall is harnessed to make _____

cut

1900 1905 1910 1915 1920 1925

1903
The engine in the Wright brothers' plane is powered by _____

1905 Albert Einstein develops a theory for measuring energy and prepares the way for the _____ age.

1910
Ford makes the first Model _____ car.

By the end of this period, many new homes have coal furnaces in the basement. And more and more cars appear in garages.

cut

1930 1935 1940 1945

1926
Robert Goddard tests a _____

1936
Hoover Dam on the Colorado River is built to generate _____ power.

1940

_____, a fiber made from oil, coal, and water makes its first public appearance.

1942
In Chicago, Enrico Fermi sets off the first _____ chain reaction.

Many homes convert from coal to natural gas for heating. Most families own at least one car and some have two.

cut

1950 1955 1960 1965 1970 1975

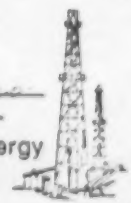
1952
Bell scientists raise hope for our energy future with the _____ battery.

1957
The U.S. gets its first big _____ electric power plant at Shippingport, Pa.

Demands for energy grow. America gets more people, more homes, more factories and businesses, more cars, more trucks, more buses, more planes. Demand grows faster than supply.

1970
Congress passes the _____ Air Act.

1973
OPEC nations _____ oil and produce an energy crisis.



1980 Americans continue to look for ways to _____ the energy we have and find new _____ sources.

cut

LESSON 3

THE GOOD OLD DAYS

CONCEPT: Energy

SKILL: Cultural exploration through local history.

OBJECTIVE(S): Students will have an opportunity to discover how petroleum and natural gas have changed American life styles through the years.

INTRODUCING THE LESSON:

1. Students will be asked what they think life was like fifty year ago.
2. Hand out activity sheet.
   (a) Students are to interview their parents, grandparents or oleder person in the neighborhood.
   (b) Students may add their own questions to the interview.
3. After a week to get the interview, students will discuss their results.

EXTEND LESSON: Students will write a letter or diary entry to be placed in a time capsule, describing life today.

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The Good Old Days?

Interview someone who is old enough to remember what life was like before the days of great usage of oil and natural gas. Ask him or her the questions that follow and others that you think of yourself.

1. What kind of lights did you use in your home? _____
   _____ How was it heated? _____
2. What fabrics were clothes made of? Was clothing harder or easier to take care of?
   _____
3. What sort of washing machine did you have? _____
4. What kind of stove (and what kind of fuel) did your family use for cooking?
   _____
5. Did you have a refrigerator? How did you keep your food fresh? _____
   _____
6. How was food packaged when it came from the store? _____
   What did milk come in? _____ Was your milk delivered? _____ How?
   _____
7. What sort of soap did you use? Did it clean as well as the cleaners we have now?
   _____
8. How was your water heated for bathing and laundry?
   _____
9. Did your family have a car? _____ If not, how did you travel? How did you get to school? _____
10. Did you have a radio? What did it look like? _____
    _____ Did you go to the movies? _____
    What kinds of entertainment did you enjoy? _____
    _____

(Think up as many more questions of your own as you can. Ask them during the interview. Put the answers on the back of this paper.)

To close the interview, ask these questions and write the answers on the back of this paper.

In what ways is life for you more enjoyable now that we have electricity, plastics, detergents, and other oil and natural gas products?

In what ways did you like the "good old days" better?

LESSON 4

HISTORY OF ENERGY CONSUMPTION IN UNITED STATES

SKILL: To be able to obtian information from a graph.

OBJECTIVE: Students will be able to gather information from a graph.

INTRODUCING THE LESSON:

1. Hand out activity - let students complete.
2. Have the students discuss the resource demands of the U.S. back in the early 1900's.
   (a) Were the demands for electricity greater then or now? (Electrical demands are increasing by at least 5% every year.)
   (b) Was the demand for oil greater in the early 1900's or or now? (Oil demands are hundreds of times greater now.)
   (c) Is the demand for wood products greater now or back in the 1900's? (Much greater now.)
   (d) What has caused this increase in demand for these resources? (Increased population plus a high standard of living. The increase in electrical appliances, automobiles, and numbers of homes also contribute to the demands.)
3. What can you do to help reduce the demand for energy?

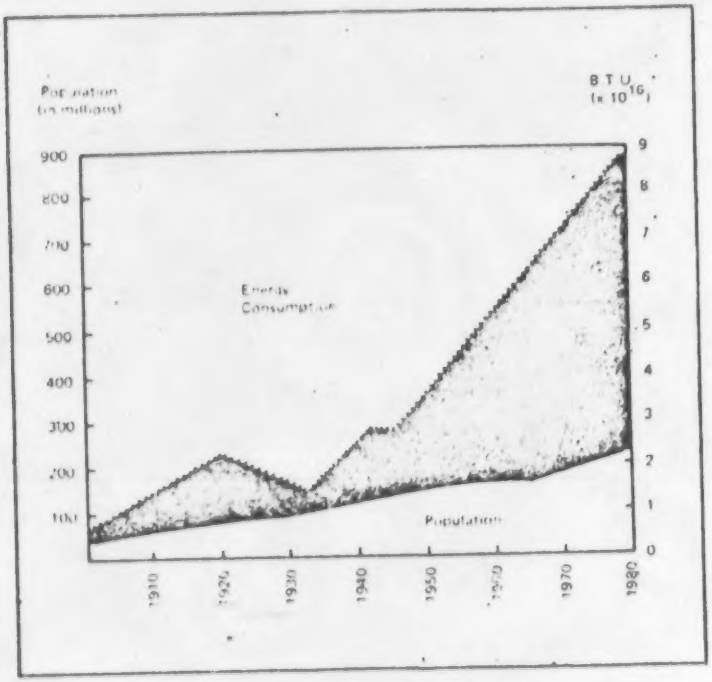


Figure 1. History of Energy Consumption in the United States

Graph from The History of Energy, U. S. Department of Education.

1. What year showed the smallest use of energy?
2. What year showed the largest use of energy?
3. What is the difference between the use in 1930 and 1980?
4. What event in history could account for the drop in the 1930's?
5. Why do you think there has been a steady increase since 1950?
6. What can be done to help reduce the constant demand on energy?
7. What can you do to help.

LESSON 5

OBITUARY TO A "GAS GUZZLER"

CONCEPT: Energy supplies are limited

OBJECTIVE: To discover the relationship between energy supplies and automobile engine efficienty.

DEVELOPING THE LESSON:

1. Read this to your class: A television news story stated that "An association of wners of Rolls-Royce automobiles is lobbying for special consideration for their gasoline needs in the event of a gasoline shortage. Their reason: they are unique, and their 5 mile-per-gallon 'gas guzzlers' are an important element of the good life of America and should be maintained." The owners also expressed their willingness to pay a penalty tax of $500 to $1000 to offset their high use of energy.
2. Ask: "Do you think the large, luxury car owners have a valid argument?"
3. Discuss the pros and cons of their case.
4. Ask: "Do you believe a penalty of $500-$1000 would make up for their excessive use of gasoline?" (Their cars cost up to $75,000.)
5. Check with your local big-car dealers to determine any changes in their automobiles since the oil crisis of 1973 in:
   (a) weight of automobiles.
   (b) gasoline efficiency in miles-per-gallon.
   (c) sales volume.
   (d) advertising (efficiency vs. luxury).
6. Survey small-car dealers to determine any change in the numbers of big-car owners who have traded in their "gas guzzlers" for a small automobile.
7. Investigate the availability of diesel engine automobiles.
8. Write an obituary to a "gas guzzler".

EXTEND LESSON:

1. Design an epitaph to a "gas guzzler."
2. Ask: "What will take the place of the large luxury car in the dreams of people?"
3. Have the class observe a moment of silence for the last "gas guzzler."
4. Compare the worst "gas guzzling" automobile with a yacht or private airplane.

LESSON 6

ENERGY ADS

CONCEPT: People make demands on limited energy supplies.

OBJECTIVE: To discover the relationship between energy shortage and advertisements for business products.

DEVELOPING THE LESSON:

1. Collect energy industry advertisements from newspapers and magazines and discuss their messages to the public.
2. Classify the advertising into categories. (Price rise justification; "what a good job of conservation we're doing"; cost of regulation; "survival" ads arguing against divestiture of competing energy sources, etc.)
3. Discuss the validity of each of the categories of advertisements you collected.
4. Ask: "Are the arguments of the energy companies persuasive?"
5. Look for ads that "turn you off"; "turn you on."
6. Discuss the reasons for the "turn off" or "turn on."
7. Collect ads from other businessor ir industries that contain an energy message. (low mileage cars, etc.)
8. Look for ads which indicate a change in approach because of the energy shortage. (large cars emphasizing mileage and smaller size instead of luxury, etc.)
9. Ask: "Why would an electric power advertisement call for conservatin and decreased use of electricity?" (Power companies can no longer meet the unlimited demands of people for electricity.)
10. Create a "billboard" advertisement for your school which stresses conservation of electricity.

EXTEND LESSON:

1. Design a cover for a new magazine to be called EN-ER-GEE.
2. Write an advertisement to appeal to new subscribers for your new magazine.
3. Design and produce a TV commercial.
4. Write a radio commercial.

LESSON 7

"WHO - ME?"

CONCEPT: Each individual has a responsibility to conserve energy.

OBJECTIVE: To discover the relationship between the "energy crisis and me."

DEVELOPING THE LESSON:

1. Ask: "Are you part of the energy problem?"

2. Ask: "What have you done today to conserve our scarce energy supplies?"
3. Make a list of the things students did to conserve energy during the past week.
4. Ask the students who feel that they are not part of the energy problem to defend their position. Have a recorder keep a record of the discussion.
5. Ask the students to record for one week:
   (a) number of times they opened the refrigerator
   (b) asked their parents to drive them somewhere
   (c) rode a bike instead of asking for a ride in a car
   (d) drank a cold drink
   (e) used ice cubes
   (f) took a hot shower
   (g) sat in an over-cooled room
   (h) watched TV
   (i) add another item.
6. Ask again: "Are you part of the energy problem?"

EXTEND LESSON:

1. Discuss how the energy shortage has changed the lives of members of the class and their families.
2. Investigate the effects on the school, the community, the state, the nation.
3. Discuss changes in the lifestyles of people and how they might be affected by continued energy shortages. (We will still live the "good life" even if we conserve energy.)

MATH/ENERGY MATERIALS

These are materials that deal with energy concepts and mathematics skills. Each activity is keyed to a State eighth-grade skill. These are listed at the beginning of the activity: Standard Letter and Skill Number; for example: C-7 is Standard C, Skill 7.

Some of the activities involve more than just the basic skill, but we feel the activities are useful for both math and energy.

LESSON 1

MAP/MATH SKILLS — MATH SKILL: X-50

This activity requires the use of the map of the Great Lakes region and ACTIVITY MASTER 20. The students are assigned the task of getting to the Silverdome from a certain city and computing the number of energy units it will take to get there by whatever travel mode they have chosen. Begin the activity by assigning each student to one of the six cities below. Assign some students to Pontiac itself, at two different distances away from the stadium.

Detroit
Grand Rapids
Lansing
Toledo
Columbus
Cleveland
Pontiac (5 miles from stadium)
Pontiac (10 miles away from stadium)

NOTE: A Teacher Fact Sheet has been included. The Fact Sheet illustrates the energy units used in each method of transportation. See graph below.

Distribute copies of the map and Student Activity Master. Then ask students to complete the question sheets.

Conclude the activity by asking students to report on the method they used to get to the stadium on a set number of energy units. Did they find other ways to travel?

DISCUSSION POINTS:

You may wish to bring out the following elements regarding transportation and energy conservation:

1. Car efficiency (miles per gallon).
2. Location (distance from the stadium).
3. Use of mass transit.

How would traveling by bus or train all the time affect your life? How might it conserve energy?

OPTIONAL ACTIVITIES:

Play the game again. This time assign each student a different city. Repeat the procedure for figuring the energy units.

Have a small group investigate the public transportation facilities in their city. Make a report on how often the subway (or bus or train system) is used, and by how many people.

Transportation to the Stadium

Teacher Fact Sheet

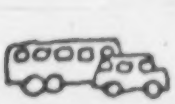
Tabulated below are the energy units used by each method of transportation in traveling from each city to the Silverdome.

Transportation Information	Per Person Per Mile
Auto with one person	= 20 energy units
Auto with two people	= 10 energy units
Auto with five people	= 4 energy units
Bus with 44 people	= 1 energy unit

City	To Silverdome	Energy Units 1 Person Auto	Carpooling-Energy Units 5 Person Auto	Bus
Pontiac	5	100	20	5
Pontiac	10	200	40	10
Detroit	30	600	120	30
Lansing	64	1280	256	64
Toledo	91	1820	364	91
Grand Rapids	135	2700	540	135
Cleveland	197	3940	788	197
Columbus	232	4640	928	232

Cut-off line for a max of 700 units

*From the National Science Teachers Association's Unit Booklet: The Energy Dome (Con-Copyrighted)



GOING to the SILVERDOME

To complete this activity you need:

1. The map of the Pontiac region.
2. The travel information given below. Fill in the blanks.

Travel Information		Per Person Per Mile
Auto---One Person	=	20 energy units
Auto---Two People	=	10 energy units
Auto---Five People	=	4 energy units
Bus----44 People	=	1 energy unit

Your city is _____ (ask your teacher).

It is _____ miles from Pontiac (map).

You have 700 units to use for transportation to get to the stadium.

Your assignment is to get to the stadium.

Answer These:

1. How many units does it take to go by yourself in a car? (Miles to travel multiplied by the correct number of energy units per mile given above.) _____
2. Do you have that many? _____
3. How many units do you use if you share a car with a friend? _____ How many units do both you and your friend use? _____
4. How many do you use if you take four friends? _____
5. How many units do you use if you take the bus? _____
6. How should you travel to the stadium to save the most energy units? _____

After you have put the two puzzles together, answer these:

1. Write in the numbers on the pieces for each circle. (Be careful. Do not mix the pieces from one circle to another.) Add the numbers. If the numbers do not total 100%, find out how much is missing.

U.S. Consumption	U.S. Production
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
Total _____	Total _____

2. Each circle should have the same amount of each fuel. What is missing? _____

3. Write in the place where you think the missing fuel comes from.

_____

4. Write in your own words the meaning of "import".

_____

5. List five ways Americans use oil.

_____ _____ _____

_____ _____

6. Think of a way to conserve oil. Write your idea in the space below.

Note: Keep your puzzle pieces. You will need them later.

7. How many different ways can you travel to the stadium without going over your 700 limit? _____

_____

8. Could you go to the stadium more than once? _____

9. If you take four friends how many energy units do you save compared to going by yourself? _____

10. Can you think of other ways to go to the stadium? _____

_____

11. Why might you prefer to drive your own car? _____

_____

12. Why might taking a bus be a good idea? _____

_____

_____

DISTANCES FROM MAJOR
CITIES TO
PONTIAC SILVERDOME
CANADA
MONTREAL
615 Mi.
TORONTO
255 Mi.
WISCONSIN
MICHIGAN
GRAND
RAPIDS
135 Mi.
FLINT
PORT
HURON
LANSING
64 Mi.
PONTIAC
MILWAUKEE
411 Mi.
BUFFALO
282 Mi.
DETROIT 30 Mi.
NEW YORK
ANN ARBOR
CHICAGO
301 Mi.
TOLEDO
91 Mi.
CLEVELAND
197 Mi.
NEW YORK CITY
697 Mi.
PENNSYLVANIA
INDIANA
OHIO
PITTSBURGH
315 Mi.
ILLINOIS
COLUMBUS
232 Mi.
INDIANAPOLIS
304 Mi.
CINCINNATI
285 Mi.
LOUISVILLE
397 Mi.
KENTUCKY

LESSON 2

OBJECTIVE: The student will become aware of the relative monthly costs of various energy consuming appliances found in the home.

MATH SKILL: The student will read and write money values through $1000. (Standard B - Skill 4)

DIRECTIONS: Fill in the blanks below by writing in the given money value in words or numerals.

The average South Florida home in 1980 consumed $100 worht of electricity per month. Of this total monthly cost, approximately forty-seven dollars (_____) was spent on cooling the home, about fourteen dollars and twenty-three cents (_____) was spent on heating water and ten dollars and seventy-three cents (_____) was spent on refrigeration. Only $8.12 (_____) was spent on heating the home, while $6.62 (_____) was spent on cooking food. Only $5.26 (_____ was spent for lighting the home.

LESSON 3

OBJECTIVE: The student will become aware of the relative KWH consumption of various energy consuming appliances found in the home.

MATH SKILL: B-5

DIRECTIONS: Fill in the blanks below with the correct word name or numeral.

The average South Florida home in 1980 consumed 2,000 kilowatt (KWH) of electricity per month. Of this total monthly usage, approximately nine hundred forty (_____ KWH was consumed for cooling purposes, about two hundred eighty (_____) KWH was used in heating water and two hundred twenty (_____) KWH was used for refrigeration. Only 160 (_____) KWH was used for heating the home, while 120 (_____) KWH was used for cooking, while lighting consumed 100 (_____) KWH. What other ways is electricity consumed in the home?

LESSON 4

HOME ENERGY USE Math Skill: X48

CONCEPT: Most people are not aware of how many things in their home use electricity.

OBJECTIVE: To find the number of kilowatt hours used by outlets and applicances in the home.

INTRODUCING THE LESSON:

1. Show them the estimates that you would make and ask if they think you estimated well.
2. Then show them the actual amounts from your own house, and the costs.

DEVELOPING THE LESSON:

1. Give them the estimating worksheet and have them fill it out for their own homes.
2. Tell them to take the worksheet home and record the actual number of outlets and any applicances overlooked.
3. The next day, have them star the appliances that are used every day and figure the costs, using the chart of average KWH consumption.

EXTEND LESSON:

1. Discuss ways that the number of KWH and cost could be reduced. (Turning off TV when they go outside, smaller refrigerator, washing dishes by hand, etc.)

ENERGY USE SURVEY SHEET

DIRECTIONS: FILL IN THE CHART FROM MEMORY. TAKE YOUR CHART HOME AND COMPARE YOUR ESTIMATES TO THE ACTUAL COUNT.

PUT A STAR BY APPLIANCES THAT ARE USED DAILY. USE THE CHART ON THE BACK TO FIGURE THE COST OF THE STARRED ITEMS.

	KITCHEN	LIVING ROOM	DINING ROOM	BEDROOMS	BATHROOM	OTHER
I. [ ] COUNT AS TWO LIST NUMBER OF OUTLETS	ESTIMATED AMOUNT___ ACTUAL AMOUNT___	ESTIMATED AMOUNT___ ACTUAL AMOUNT___	ESTIMATED AMOUNT___ ACTUAL AMOUNT___	ESTIMATED AMOUNT___ ACTUAL AMOUNT___	ESTIMATED AMOUNT___ ACTUAL AMOUNT___	ESTIMATED AMOUNT___ ACTUAL AMOUNT___
II. LIST APPLIANCES USED IN EACH ROOM, BY MEMORY						
III. CHECK EACH ROOM. LIST APPLIANCES THAT WERE OVERLOOKED.						

NAME_____ DATE_____

AVERAGE MONTHLY KILOWATT-HOUR CONSUMPTION OF TYPICAL APPLIANCES FOR A FAMILY OF 4.

	KWH
COFFEE POT	8
DISHWASHER	30
MIXER	1
MICROWAVE OVEN	15
RANGE (SELF CLEAN OVEN)	70
TOASTER	3
FREEZER (15 CU. FT.)	99
REFRIGERATOR (14 CU.FT.)	94
FROSTLESS REFRIGERATOR (18 CU. FT.)	248
CLOTHES DRYER	83
WASHER	9
IRON	12
WATER-HEATER (42 GAL, QUICK RECOVERY)	300
WATER HEATER (WITH DISHWASHER & CLOTHES WASHER)	350
ATTIC FAN	24
HAIR DRYER	1
SHAVER	0.15
RADIO	7
B & W T.V. (TUBE)	29
B & W T.V. (SOLID STATE)	10
COLOR T.V. (TUBE)	55
COLOR T.V. (SOLID STATE)	37
SEWING MACHINE	0.9
VACUUM CLEANER	4

LESSON 5

OBJECTIVE: The student will become aware of the concept of per capita energy consumption in the home.

MATH SKILL: The student will divide a 5-digit number by a 1-digit number. (Standard I - Skill 16)

DIRECTIONS: Divide to find the KWH of electricity used per person.

Assuming that each of the five families listed on the next page each consume 24,000 KWH of electricity per year, find out how much electricity is used per person in each home.

FAMILY	NO. OF PERSONS IN THE HOME	KWH USED PER PERSON
Smith	6	
Jones	4	
Washington	2	
Williams	5	
Roberts	3	

LESSON 6

HOW TO SAVE GASOLINE...AND MONEY

CONCEPT: A well-maintained car, carefully driven, can save gasoline and money.

OBJECTIVE: To inform students of the costs of driving, why it pays to save gasoline, and ways to conserve gasoline.

INTRODUCING THE LESSON:

1. Write to: U.S. Department of Energy
   Office of Public Affairs
   Washington, D. C. 20585

   Ask for: "How to Save Gasoline...and Money".
2. Have a class discussion about kinds of cars the students parents' own.

DEVELOPING THE LESSON:

1. Give out the pamphlets from the U.S. Department of Energy. Have the students read sections aloud. Pay special attention to "What It Costs to Drive." Discuss each section as the student reads it.
2. Give worksheets for students to do.

EXTEND LESSON:

1. Lead the class in a discussion about the money that would be saved if everyone in town (get population) follwed the recommendations (or at least the first three main categories).
2. Lead them to discover that at $1.00 per gallon a savings of 5¢ represents a gas savings of 5%. Have them find number of gallons that could be saved if 500 people with 22-gallong tanks did the first three steps.

For the problems one through four below, assume gas costs $1.00 per gallon (we wish!), and you have a 22 gallon tank.

1. How much can you save by driving more efficiently (per full tank)?
2. How much can you save by selecting high-mileage oil (per full tank)?
3. How much can you save per tank if you take all the steps except replacing your present car?
4. How much can you save per full tank if you drive more efficiently and care for your car as suggested?

---

5. If gas costs $1.50 per gallon, how much can you save per gallon by getting tune-ups and adjustments when needed?
6. How much can you save in problem number five if your car has an 18 gallon tank?

How To Save Gasoline... and Money

"You mean I could save up to 12 percent on my gasoline bills just by keeping my car tuned?

"...or 5 percent just by keeping my tires inflated to the tire manufacturer's recommended levels?

"...or between 3 and 10 percent by switching to radial tires?

"...and 20 percent on the highway merely by driving carefully and never exceeding 55 miles per hour?

"I'm interested. Tell me **How.**"

"Gladly. But first, let me tell you What and Why..."

What It Costs To Drive

If you're a typical driver, your car:

- travels over 11,000 miles per year
- consumes nearly 800 gallons of gasoline annually (just over 2 gallons per day)
- has an average fuel economy rating of 14 to 15 miles per gallon, and
- costs over $600 per year for gasoline alone (over 5 cents per mile).

Those figures assume that you're driving a private automobile in an urban area. Yet, even if you have a long commute, use your car for business, operate a light truck, or for some other reason exceed those averages, the relative impact of gasoline costs on the pocketbook remains the same.

Why It Pays To Save Gasoline

By driving more efficiently, you could easily:

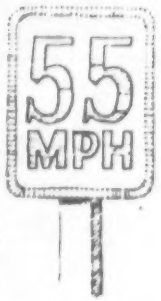
- cut gasoline consumption by 40 to 80 gallons per vehicle, probably without eliminating any necessary travel and without inconvenience or sacrifice, and
- **save $30 to $60 or more per year.**

The money saved is like getting a discount on the gasoline you buy, amounting to 4 to 8 cents per gallon, perhaps a dollar or more per tankful. In fact, by planning your trips, caring for your car properly, and taking **all** of the steps recommended in the table on the far right hand page, you can lower your gasoline bills considerably.

Gasoline is an essential form of energy, one we can no longer afford to waste. It is refined from crude oil, a finite natural resource. Approximately half of our oil supply is imported, and its price and availability are determined largely by the oil exporting countries. By saving gasoline, we can extend domestic oil supplies until alternate sources of energy can be developed. Moreover, the less you drive, the more you cut costs and petty aggravation, air pollution, traffic congestion, and accidents. And the more you help blunt the impact of OPEC-dictated price increases.

Passenger automobiles account for about 13 percent of all end-use energy consumption in the United States, and about 31 percent of all the petroleum used. If every driver of the more than 100 million private automobiles, plus some 20 million light trucks, reduced gasoline consumption just 5 percent the total savings would be more than 5.5 billion gallons of gasoline per year. That's enough, in savings alone, to drive the average car between New York City and San Francisco about 25 million times—or for all of New York City's 8 million people to drive coast-to-coast three times.

How To Drive More Efficiently



1. **Drive at a moderate speed.** The most efficient range usually is 35 to 45 miles per hour. On the highway, where you may need to maintain a higher speed, stay at 55 mph. Most automobiles get about 18 percent better mileage on the highway at 50 than at 65 mph, and 20 percent better mileage at 55 than at 70 mph. You may note that some drivers abuse the speed limit on super-highways, but state police are cracking down on speeders.

2. **Drive at a smooth and steady pace.** Press lightly but steadily on the accelerator so that you flow smoothly through traffic. Avoid tailgating, unnecessary accelerating, and braking.

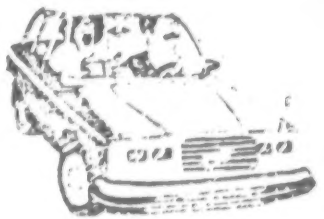
3. **Drive "defensively."** Anticipate traffic flow 10 to 12 seconds ahead. Maintain 2 or 3 seconds of buffer space between your car and the others around you—calculated by noting when the car ahead passes a fixed point, and counting the seconds until you reach that point. This gives you the necessary time and space to drive safely and use your energy efficiently.

4. **Don't idle the motor for longer than 30 seconds.** Idling gets zero miles to the gallon. Driving slowly for the first few minutes is a much more efficient way to warm the motor than excessive idling, even after the car has stood overnight. Also, turn off the ignition any time you expect to wait more than 30 seconds or so; restarting will take less gasoline than idling. Remember this rule when waiting in line, for instance, at a drive-in window.

5. **Keep windows closed when driving at highway speeds.** Open windows increase wind resistance by creating drag. If the outdoor temperatures permit, use flow-through ventilation. If heating or cooling is needed, use a moderate setting.

B4

How To Plan Your Trips



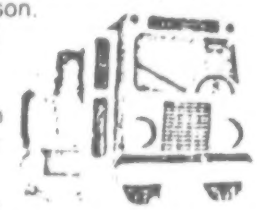
1. **Share the ride.** About one-third of all private automobile mileage is for commuting. When two people ride together, say to work, they use about half the gasoline required if each drove alone. Many employers offer incentives such as free or reduced-rate parking for carpools. Consider organizing or joining a vanpool; the trend towards vanpools is increasing.

2. **Combine trips.** Plan your trips—to market, to the library, to school, or to visit friends. You'll

often find that one neighborhood jaunt could serve two or three purposes, and you could help your neighbors by offering to run errands for them. Gasoline costs about 5 cents per mile, and much more for short trips. Make your shopping or optional trips when traffic is lightest, and return home before the rush hour starts. Patronize your nearest group of stores.

3. **Eliminate unnecessary trips.** Find one trip a day which might be better handled—or even eliminated—by telephoning, writing, or combining with another trip. For instance, banking often can be done more quickly and more efficiently by mail or telephone than in person.

4. **Take public transit if available.** On buses and trains one can read, daydream, sleep, or catch up on work. When public transit isn't available, groups of commuters sometimes charter buses, or form vanpools, frequently with support from employers.



How To Care for Your Car

1. **Check tire pressures regularly.** Keep tires inflated to the manufacturer's highest recommended level. Most such recommendations are for cold pressure, so buy a good quality gage and take readings before starting out. Become familiar with the difference between your tires' cold and hot pressures, and adjust accordingly. You can improve mileage 1 percent for every 2 pounds of tire pressure needed to bring them up to standard.

2. **Replace all four tires with radials.** They will generally give 3 to 5 percent improvement in gas mileage in the city, and up to 10 percent on the highway. When you buy a new car, specify radials. They last longer, give better mileage, and often provide better steering qualities. But don't mix radials with conventional tires—it can be dangerous.

3. **Have wheels properly aligned.** Improper wheel alignment can increase fuel use and cause unnecessary tire wear. A regular alignment check is a good idea. Also, check the alignment after the wheels have had a jolt—from striking potholes, bumps, or curbs.

4. **Are your brakes adjusted?** Brakes that drag or grab unevenly rob you of gasoline, and can be dangerous. Be sure that the brakes both grip and release properly.

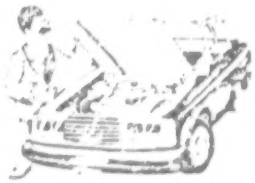
5. **Use gasoline of the proper octane rating.** The owner's manual gives the gasoline octane rating and gasoline type recommended by the auto manufacturer. What you want is octane just high enough to prevent knocking.

6. **Check and change oil and oil filter at recommended intervals.** Every time you add gasoline, check the oil. Dirty oil or a low oil level can cause friction and wear that rob you of gasoline mileage and can seriously damage your engine.

7. **Use a good quality SE multi-grade (multi-viscosity) oil.** Look for the API SAE rating on the container. Multi-grade oils like 10W-30 and 10W-40 help reduce internal engine friction and give better gasoline mileage than single-grade oils. Do not use an oil of higher viscosity than recommended in your owner's manual since heavier oils tend to increase friction and decrease miles-per-gallon efficiency. A lower viscosity oil such as 5W-30 is recommended for winter months in a cold climate. Consider using the super oils; they increase fuel economy and give better protection against wear of motor parts. Always use oils that are marked SE.

8. **Do the little things prudence requires.** Don't overfill the gas tank; eliminate any chance of spillage. Don't carry unnecessary weight. For every additional 100 pounds, mileage goes down as much as four-tenths of a mile per gallon. For safety's sake, never carry a can of gasoline in the trunk.

9. **Have you had an engine tune-up recently? Do you need one?** If your engine is hard to start, hesitates, sputters, idles roughly, or the like, you are



losing mileage and should check its condition immediately. You may need to clean and adjust spark plugs and ignition points, replacing if necessary; check timing; and replace air and fuel filter elements. How much you will save on gasoline consumption will depend on the condition of your engine and how much you drive in the course of a year, but savings could range up to 12 percent on your gasoline bills.

Here are some other key points.

- Remove foreign matter from the exhaust gas recirculatory valve and hoses, and check the controls following the manufacturer's specifications.
- Check for leaks in the fuel system.
- Check, clean or, if necessary, replace the positive crankcase ventilating valve (PCV).
- Check all electrical ignition wiring and connections for voltage drop and resistance; clean, tighten, and replace if necessary.
- Inspect the choke for proper operation.
- Set idle speed to manufacturer's specification.

How To Choose Your Next Car

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1. **The greatest single step you can take to save gasoline is to choose your next car carefully.** Here's how:

— If you are in the market for a new car, consult the "Gas Mileage Guide for New Car Buyers," available free from any dealer or by mail; write Fuel Economy, Pueblo, CO 81009. Study the tables carefully. They give the most complete and accurate information available on the relative fuel economy performance of all current model cars, station wagons, and light trucks. The estimates are in terms of miles per gallon measured on the Environmental Protection Agency's standardized fuel economy test. The actual mileage you get will depend to a large degree on how and where you drive—and on following the tips on savings gasoline and money found in these pages. But the Guide can be very helpful. Compare specifications and test results. You can save hundreds of dollars a year at no sacrifice—

simply by choosing an economical car from the class in which you are interested.

— If you expect to buy a used car, first consult the auto magazines or buyer's guides published by the consumer testing organizations. These should be available at the public library. In buying a car, choose the size needed to satisfy your normal driving patterns. Consider such things as the car's weight, and select the lightest car in the class. Also, choose the one with the lowest practical number of cylinders. Choose manual transmission if most of your driving is typically on the highway. And avoid power option extras. If you need extra passenger or trunk room occasionally, consider buying a compact and renting a station wagon once or twice a year.

2. **As said before, do the little things prudence requires.** Select a light-color car for a warm climate—to reflect the sun's rays; you might not even need air-conditioning, or if you have it, you might not use it much. Tinted glass or a light-colored interior also helps cut down on heat inside the car. If you don't need an installed luggage rack on top, specify a model without one; it adds to wind resistance. Above all, don't let an over-zealous sales manager pressure you into buying "the latest model" left on the floor or lot. You'll be driving—and paying for gasoline—for a "lifetime," the lifetime of your ownership of the car.

Why Not Also Consider...

1. **Local laws that can help you save energy.** Those that help reduce automobile gasoline consumption might include: increasing availability of public transportation; express lanes for ridesharing vehicles and buses during peak commuting hours; one-way streets in heavy traffic areas; synchronized traffic lights; right turns on red; banning stopping, standing or parking on arterial streets during rush hours; and providing overpasses at busy intersections.

2. **Vacationing close to home.** Discover nearby attractions. A nearby hotel, resort, or campground might provide as satisfying a change from routine as a similar one up to thousands of miles away.

3. **Rediscovering the pleasures of walki hiking, jogging, and bicycling.** Does anyor have to be reminded that these modes of transportation, relaxation, and exercise consu no gasoline?

4. **Forms of motorized transport which compare favorably to automotive efficienc** A two-wheeled vehicle might meet your transportation needs.

How To Set Your Own Gas-Saving Goal

To help achieve conservation objectives in tl face of tight oil supplies and rising prices, President Carter, in his April 5, 1979, energy address to the Nation, called on all of us to drive 1 fewer miles per week. "At least once a week tak the bus, go by carpool—or, if you work close t home, walk," he suggested.

"Conservation is our cheapest and cleanest energy source," the President said. "It helps to control inflation, and every barrel of oil we save is a barrel we don't have to import."

If every driver cut normal driving by 15 miles a week, savings would add up to about 450,000 barrels of oil per day—oil that would not have to be imported.

How can you reduce your driving by 15 miles per week? By putting into practice the tips in the section here on "How to Plan Your Trips."

How can you reduce your gasoline bills by 40 percent or more? By putting into practice **all** of the tips listed here. The table on a preceding page summarizes the major categories of these tips, and shows representative savings.

Would you like more tips? For a free pamphlet "Tips for Energy Savers" and/or a half-hour, 16 mm color movie "Running on Empty" suitable for driver education classes or other groups, write ENERGY, BOX 62, OAK RIDGE, TN 37830.

U.S. Department of Energy
Office of Public Affairs
Washington, D.C. 20585

DOE/OPA-0044 (5-79)

Add Up Your Savings, Step by Step, Gallon after Gallon, Tankful after Tankful, Year after Year

If you take all of the steps in this column:	It's the same as saving about this much on each gallon of gasoline:*
	If gas costs $ 1.00
How To Drive More Efficiently	
Warm engine correctly	
Drive at a moderate speed	
Accelerate briskly and steadily	
Anticipate what's ahead—leave buffer around your car	
Flow smoothly through traffic ... altogether,	5¢
How To Plan Your Trips	
Rideshare to work with a friend	9¢
Plan family errands	
— combine trips	
— use the telephone and mail	
— ride with others ... altogether,	3¢
Plan social and recreational trips	
— combine trips	
— rideshare ... altogether,	3¢
How To Care for Your Car	
Inflate tires to highest recommended pressure	3¢
Select high-mileage oil	2¢
Get tune-up and adjustments when needed	4¢
How To Choose Your Next Car and Tires	
Buy radial tires	2¢
Replace your present car with another that gets 10 mpg more than your present one	18¢
You can save:	49¢

*These savings are slightly smaller than the individual figures given in the text because each amount shown here is based on the assumption that you take **all** of the steps.

SOURCE: Transportation Programs, Conservation and Solar Applications, U.S. Department of Energy, Washington, DC 20545.